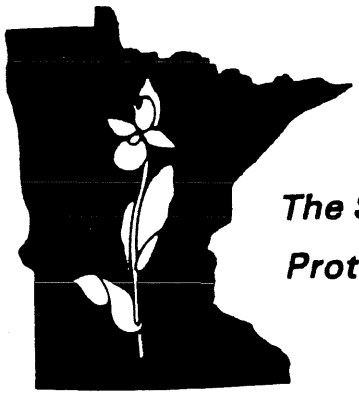
BOOT LAKE
SCIENTIFIC AND NATURAL AREA

MANAGEMENT PLAN
AND
RESOURCE INVENTORY



The Scientific and Natural Areas Program...
Protecting and Managing the Best of Minnesota's Natural World

BOOT LAKE
SCIENTIFIC AND NATURAL AREA

MANAGEMENT PLAN
AND
RESOURCE INVENTORY

A Public Use Unit

Permitted Uses Include:

.Research - Programs conducted by qualified scientists and college graduate and post-graduate students (permit required)

.Education - Primary, secondary and college programs

.Public Use - Interpretive programs and nature observation

Division of Fish and Wildlife
Minnesota Department of Natural Resources

A MANAGEMENT PLAN

BOOT LAKE
SCIENTIFIC AND NATURAL AREA

Section 17, 18, 19, 20

Township 33 North, Range 22 West

Coon Lake Beach and Linwood Quadrangles

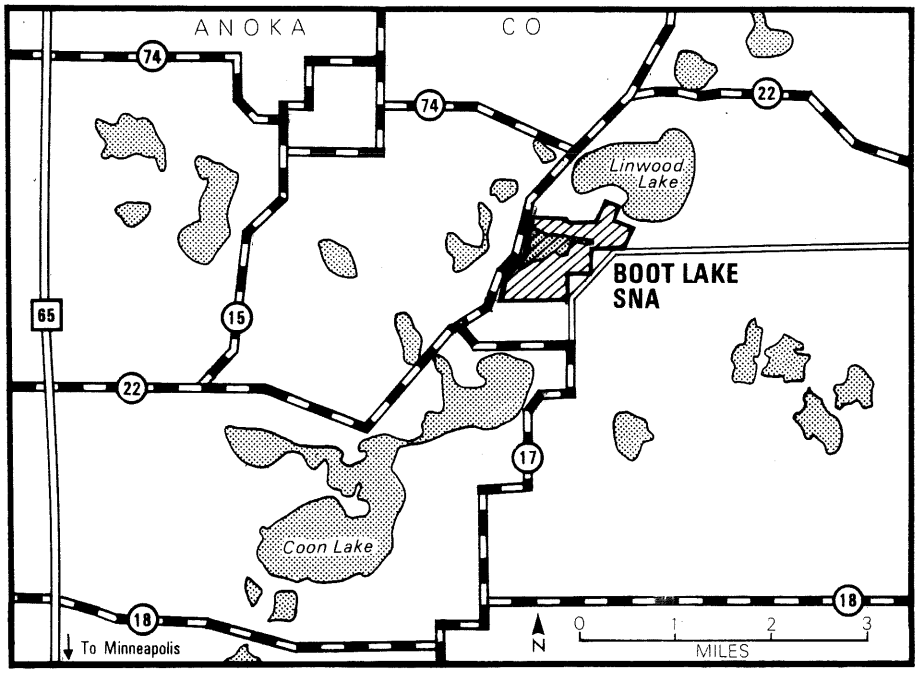
Anoka County

Prepared by the Scientific and Natural Areas Program

Division of Fish and Wildlife

Minnesota Department of Natural Resources

October 1983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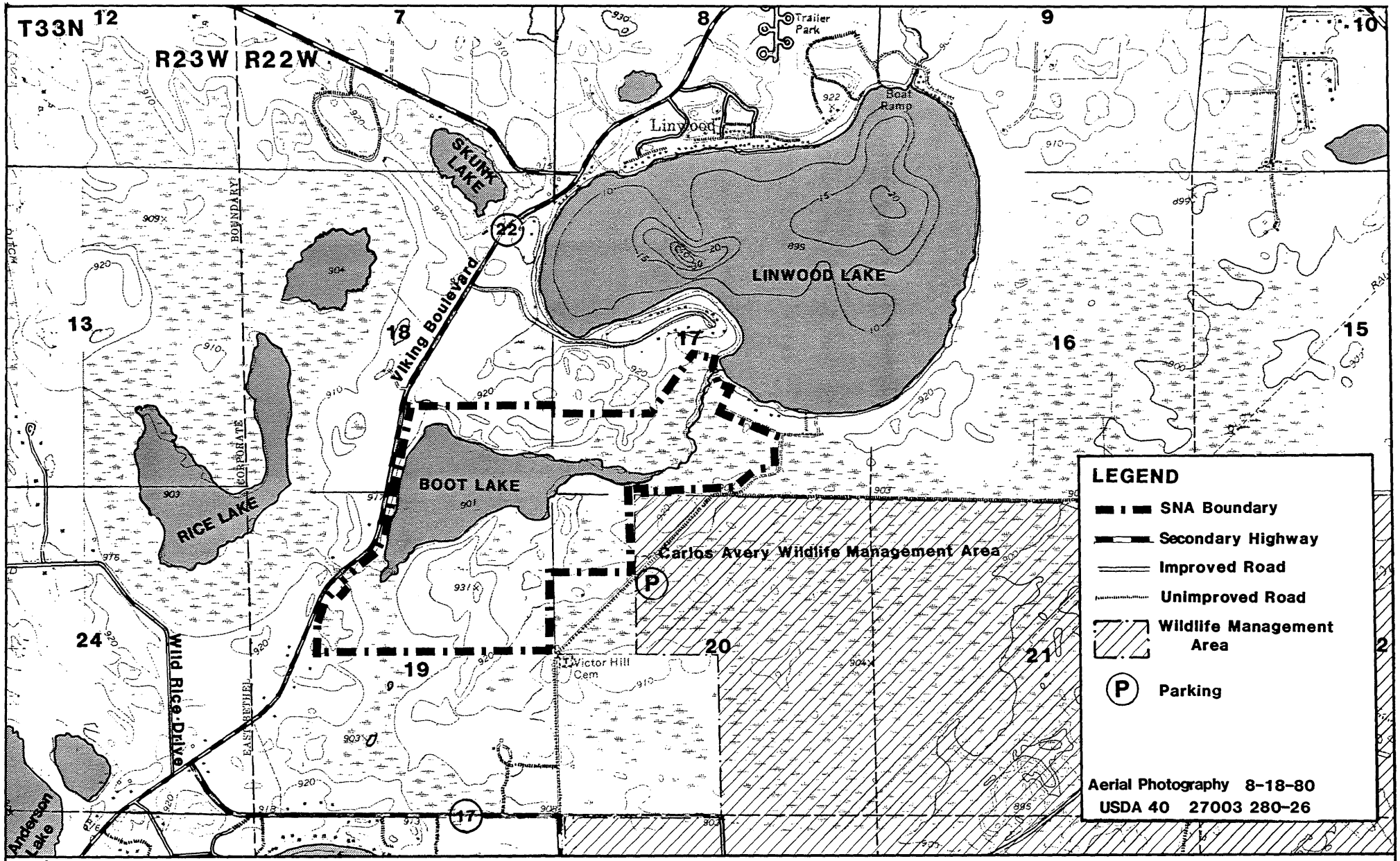

VICINITY MAP

BOOT LAKE SNA

Scientific and Natural Areas

Scientific and Natural Areas serve:

Education - elementary through high school groups use such areas as outdoor classrooms.

Nature Observation - the public uses these areas to observe Minnesota's most unique or rare natural resources.

Protection Functions - Minnesota's rarest species or most unique features are protected for the citizens of today and tomorrow.

Recreation - the public uses such areas for informal, dispersed recreation.

Research - colleges are able to establish long term research projects secure in knowing the area will not be influenced by other management activities.

Genetic Storehouse - potentially valuable plants and animals are retained thereby offering potential for new medicines, resistance to plant diseases, and other unknown secrets.

Currently there are 29 Scientific and Natural Areas protecting undisturbed remnants of Minnesota's plant communities and plant and animal species. These areas encompass maple basswood forests, virgin prairies, orchid bogs, heron rookeries, sand dunes, and virgin pine stands, as well as many rare plant and animal species.

This SCIENTIFIC and NATURAL AREA was established to protect and perpetuate Minnesota's rare and unique natural resources for nature observation, education and research purposes.

Principal activities which are UNLAWFUL in the use of this area are listed below: Further information is available at Department of Natural Resources Offices.

- *Collecting plants, animals, rocks or fossils.*
- *Camping, picnicking and swimming.*
- *Horses, dogs and other pets.*
- *Snowmobiles and other motorized vehicles.*
- *Hunting, trapping, fishing and boating.*
- *Entry into restricted areas and sanctuaries.*

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Support provided through the State of Minnesota's Legislative Commission on Minnesota Resources.

INTRODUCTION

Scientific and Natural Areas are areas of exceptional natural quality which have been formally designated for preservation, protection and management of the values inherent in their natural conditions. These values, which are for the public welfare, include use as living museums, sites for scientific study, areas for teaching natural history and conservation, places of historic or prehistoric interest and scenic beauty, and habitats for rare and endangered species of plants and animals.

The Scientific and Natural Area (SNA) system was established in 1969 and further defined by the Outdoor Recreation Act of 1975 (ORA). Nominated areas must substantially satisfy a set of rigorously drawn criteria outlined in the ORA to qualify for designation. At present there 27 designated SNA's and several more are pending.

OVERVIEW

Boot Lake Scientific and Natural Area is a 400 acre unit in northeastern Anoka County; approximately 7 miles east of Wyoming on CSAH 22. Access to the area is possible from CSAH 22 on the west, or a sand road on the east. It was designated a Scientific and Natural Area October 7, 1980. All lands within the unit boundaries are state owned.

Boot Lake itself is 92 acres in size. The maximum depth is 19 feet but it is less than 5 feet deep in most places. Wild rice grows in the lake attracting large numbers of waterfowl in the fall. The area contains several different vegetation communities. The communities range from drier oak forests and fields on sandy soils, to mixed conifer hardwood wet forests, conifer bogs, shrub thickets, wet meadows and emergent aquatic vegetation. In some areas the oak forests include white pine and jack pine. South of the lake there is considerable white pine regeneration. The herb stratum of the oak forest consists in part of species found also in northern conifer forests. The area has been settled since the 1880's and various kinds of disturbances have occurred.

Residential development in the local area has been concentrated around lakes. As a result undeveloped shoreline is becoming increasingly scarce. Land-use in the upstream watershed is predominantly agriculture, marsh, woodland, and scattered residential housing.

PRESERVATION VALUE

The Boot Lake tract occurs on the Anoka Sand Plain, also known as the Missippi River Sand Plains landscape region. It contains a diversity of both upland and wetland communites typical of this area of the state. The site also harbors occurrences of several important plant and animal species, and plant communities. These species and features are called elements. The Minnesota Natural Heritage Program has evaluated the Boot Lake tract in terms of those species or features that have been identified as elements. An element is a natural feature of particular interest because it is exemplary, unique, threatened or endangered on a national or statewide basis. The aquatic habitats were not evaluated because of the lack of available data.

Plant Occurrences

Of the plant species documented to occur in the Boot Lake tract, five species are of special interest to the Natural Heritage Program. One of the five species is an element and the status of the other four has not yet been determined. Any one of these species may be designated as an element if destruction of its habitat accelerates.

All five species are found on the periphery of their range in Minnesota. The swamp-loosestrife, mountain holly, triple-awned grass are found only in the east-central Minnesota. The huckleberry, and hawkweed are restricted in distribution to southeastern Minnesota.

Elements

1. Decodon verticillatus (water willow, swamp-loosestrife).
Records from Pine, Hennepin, Anoka and Chisago counties. Known from the Boot Lake area since 1931. This species grows at the margins of lakes, ponds, and bogs. It is considered to be an element because it occurs infrequently over a restricted range within east-central Minnesota.

Undetermined

2. Aristida tuberculosa (triple-awned grass).
Records from Wabasha, Anoka, Houston, Winona and Sherburne counties. Known in Anoka County since 1926. Although it is uncommon-to-rare outside Anoka County, it may be locally abundant in Anoka County. There is a question whether this species actually occurs on the area. It may have been mistakenly identified for Aristida basiramea which occurs abundantly where A. tuberculosa is reported to have been found. No collection of A. tuberculosa has been made on this SNA.

3. Hieracium longipilum (hawkweed).
Records from Isanti, Anoka, Wabasha, Goodhue, Winona, Ramsey, Douglas, Chisago and Dakota Counties. Known from the Boot Lake area since 1961. The typical habitat for this species in Minnesota is sandy prairies in the southeastern counties. Its occurrence in an old field at Boot Lake is more characteristic of its occurrence in southern Wisconsin and eastern Iowa where it grows in old fields, roadsides and other disturbed sites.

4. Nemopanthus mucronata (mountain holly).
Records from Wabasha, Isanti, Carlton, Anoka, Ramsey and Pine Counties. Known from Anoka County since 1927. The preferred habitat for this species is coniferous swamps. It follows a distribution and occurrence pattern similar to Rhus vernix and Decodon verticillatus in that it is limited to bogs or bog-like habitats in east-central Minnesota and is more common in adjacent Wisconsin.

5. Gaylussaca baccata (huckleberry).
Records from Ramsey, Anoka, Winona, Washington and Houston Counties. Known from Boot Lake area since 1932. This species grows in a variety of wooded habitats. Its distribution and relative abundance are comparable to Hieracium and Aristida

Animal Occurrences

Of the animal species documented to occur in the Boot Lake tract, two species are of interest to the Natural Heritage Program. The sandhill crane and the Blanding's turtle are considered to be elements. Two other noteworthy species are the snowshoe hare and turkey. Snowshoe hares are near the southern limit of their range at Boot Lake. Turkeys and turkey sign are seen frequently in the woods and fields south of the lake. They were reintroduced to the area by the DNR Section of Wildlife on the Carlos Avery WMA. Loons have been reported to nest on the east end of Boot Lake.

Elements

1. Grus canadensis (sandhill crane).
   Sandhill cranes are considered to be an element because the species distribution was once more widespread. It is threatened by the continued destruction of wetlands. In Minnesota there are two population centers, one in the northwest and one in east-central Minnesota. This second population center is concentrated primarily around Carlos Avery Wildlife Management Area which abutts directly on the eastern edge of the proposed SNA.

   During the course of the 1979 SNA inventory of Boot Lake, the field crew did not observe any sandhill cranes. However, through the Observation Card Program initiated by Carrol Henderson, DNR Non-Game Biologist, during the last couple of years there have been observations of cranes reported from the SNA.

   In 1979 W. Rohl reported that throughout April and May of that year he observed two adults on T33N R22W Section 17. He observed the birds in marsh habitat of the Boot Lake tract south of Linwood Lake and assumed the birds were a breeding pair.

   One additional observation was reported by L. Knudson and R. Johnson in the Boot Lake tract on April 8, 1977.

   During the last two or three years, several breeding pairs have been reported within one mile of the northern and eastern boundaries of the Boot Lake tract. Six to eight breeding pairs are known to occur in Carlos Avery Wildlife area. Five to ten birds are thought to be non-breeders. Sandhill cranes require large, undisturbed areas of shallow marsh. The SNA does not have much of this type of habitat. Occurrances of the species here are probably incidental.

2. Emydoidea blandingi (Blanding's turtle).
   During the amphibian/reptile survey conducted by the 1979 SNA inventory of Boot Lake, the Blanding's turtle was collected. The turtle has also been collected from other locations in Anoka County. Collection records in the state indicate that the distribution of Blanding's turtle is limited primarily to east-central and southeastern Minnesota.

   Because of the turtle's specific habitat requirements (sandy areas with marshy habitat - at least in Minnesota), its distribution is discontinuous throughout its range. Many states within its range have drawn attention to the species decreasing abundance, which is attributed primarily to the decreasing availability of wetlands.

Plant Community Occurrences

A diversity of plant communities representative of the vegetation of the Mississippi River Sand Plains landscape region occurs in the Boot Lake tract. One of these communities is considered an occurrence of a Natural Heritage Program plant community element. A plant community can be identified as an element either because it is an unusual type of plant community for Minnesota or because it is a representative example of a common plant community type.

1. Jack Pine/Bog Community.
   The most unusual plant community found in the Boot Lake tract is a five-acre wetland dominated by jack pine and tamarack with an understory of plant species found typically in bogs. Because this community is believed to be of natural origin, relatively undisturbed, and uncommon in the Great Lakes Region, it is an element occurrence.

CLASSIFICATION

The Boot Lake SNA fully meets the designation criteria for a scientific and natural area as outlined in the Outdoor Recreation Act (86A.05 Subd 5). The preserve includes (1) habitat supporting vanishing, rare, endangered and restricted plant and animal species, (2) an undisturbed plant community maintaining itself under prevailing natural conditions typical of Minnesota, and (3) an area large enough to permit effective research and educational functions and to preserve the inherent natural values of the area.

PRESERVE OBJECTIVES

These long range objectives describe what is desirable for the SNA Program to accomplish on Boot Lake SNA during the planning period (20 years). They are essentially qualitative in nature.

These objectives are the basic guides for all programs and activities on the SNA. They form the foundation on which all plans, programs and budgets are built. They are necessary to provide continuity of programs through a succession of supervisory and field personnel. They provide standards by which the success of all activities on the SNA are measured.

The preserve objectives are grouped below by priority.

First Priority:

to provide protection against existing and future intrusions

to identify, monitor and maintain priority species, communities or other significant features

Second Priority:

to identify the management requirements, and effects of management techniques on the different communities and their components

to perpetuate or restore natural conditions to a state as near as possible to those that would have been present had the natural

ecological processes not been disrupted

to develop local support and recognition for the SNA

to provide for interpretation that will enhance the understanding and enjoyment of visitors

to identify and pursue compatible management and protection of lands adjacent to the preserve that are important because:

a) these lands increase the viability of the preserve to sustain significant elements of natural diversity

b) these lands are vulnerable to development or uses that would negatively impact the preserve.

c) these lands are needed to make management safer, more efficient or more effective.

to restore highly disturbed areas to more natural conditions

to eliminate or minimize visual signs of man's previous activities in the area.

to provide for the accumulation and distribution of knowledge concerning features and conditions within the SNA

GENERAL MANAGEMENT CONSIDERATIONS

Level of Management Activity

The amount of management that takes place in a SNA is dependent on need and practicality of implementation. The level of management activity at Boot Lake SNA will be high. Several of the reasons are discussed below.

A. Proximity to the SNA Office

The closeness of Boot Lake to St. Paul permits more frequent management activities over the entire year.

B. Proximity to Carlos Avery WMA

This association offers the opportunity to utilize Carlos Avery staff expertise and observations, equipment, and possible inclusion in animal censusing programs. Ecological information gathered within the WMA can be used to compare, contrast and corroborate similar information collected from the SNA.

C. Proximity to university campuses and research facilities

A fair amount of research activity has been focused on this general area. The University of Minnesota's field research station at Cedar Creek Natural History Area is approximately 5 miles northwest of Boot Lake. With the University of Minnesota and other educational institutions so

close, research activity in the area is expected to continue. The SNA Program may be able to solicit some of this attention to Boot Lake SNA.

D. Proximity to the Metro Region

The Boot Lake SNA is located less than 50 miles from a major metropolitan area of more than 2 million people. Anoka County is rapidly being developed for residential and commercial purposes. In the future the SNA will probably experience increased use by researchers and other visitors seeking natural areas. More importantly, the SNA can be a key element in perpetuating features of Minnesota's natural heritage in the face of increasing regional development.

Historical Sites

A prehistoric Indian habitation and mound site is located partially in the Boot Lake SNA. The site has been recognized by the Minnesota Historical Society. No development is presently planned that could disturb the site

Surveillance and Enforcement

Non-conforming uses can damage natural conditions and the aesthetic appearance of natural areas. Because of the value and fragility of nature preserves, their continuing protection and maintenance should be provided on a systematic, rather than haphazard basis. The custodial function can be separated into components. Surveillance can be accomplished by developing local support and understanding of the SNA. Local citizens would be encouraged to report any signs of non-conforming uses. A local person should be assigned responsibility for scheduled field inspections, answering questions as they arise locally, and preparing an annual status report. Enforcement is the responsibility of local law authorities (Anoka County police), the local conservation officer and the SNA staff.

Action # 1	Inform the Linwood township board, other appropriate local units of government and adjacent landowners about the SNA Program and Boot Lake SNA.
Action # 2	Identify a local person to be preserve custodian.

Site Considerations:

Inspection schedule - Monthly during the year. Weekly during fall hunting season. On opening of fishing season.

Reporting - Report any signs of non-conforming uses. Report any maintenance needs (e.g. damaged signs, fences).

Clean-up

A number of areas within the SNA need to have trash removed. These are:

a. shore near the 2 boat landings on the south shore of Boot Lake
b. borrow pit and adjacent prairie
c. old boat landing site on Linwood Lake

d. deer stands (one noted just north of the western field (VI))
e. barbed wire fences on the north side of Boot Lake
-one N/S fence occurs a few hundred yards east of CSAH 22
-one N/S fence on the east section line of section 18

Action # 3 Clean-up trash and remove it from on the SNA. A general area clean-up should be scheduled annually or as needed. The local Boy Scouts have indicated an interest in assisting with this project.

Fire Protection and Control

A "let burn" policy of allowing natural fires to take their course is not recommended for the following reasons:

1. The timber type south of Boot Lake consists largely of an old-growth white pine overstory with a good stocking of white pine regeneration. A fire in this area would devastate the white pine understory.

2. The area lacks good access in several critical areas in terms of fire control.

3. In order to have a good indirect attack on a wildfire, one needs a 10'-12' wide firebreak down to mineral soil. This might require discing once a year in the fall after leaf drop. It would be impractical to get a system of firebreaks established in this area that would take care of this kind of policy.

4. State Statute 88.17 prohibits allowing a fire to spread from your land. There are no guarantees, even under ideal conditions that a fire could be stopped at or before the boundary line.

DNR Forestry,at Carlos Avery WMA, and the Linwood Township Volunteer Fire Department are responsible for fire control in the Boot Lake area. The following policies should be used in controlling wildfire on the SNA.

1. Whenever possible, use indirect attack - allowing a fire to burn into a natural firebreak.

2. Limit the use of heavy equipment in the area when fire conditions permit.

3. Indicate the SNA on the area fire dispatching map of local fire fighting authorities as an area to go light on the land.

Action 4 Arrange a joint meeting with SNA staff, Carlos Avery Forestry staff and the Linwood Volunteer Fire Department to discuss wildfire control on Boot Lake.

STRUCTURES AND FACILITIES

Signs

The perimeter of the SNA is not completely signed. Signs are needed in the lowland areas due to potential hunter or snowmobile trespass. Residents around the SNA have expressed concern that perimeter boundaries need to be more clearly signed to avoid user trespass onto private land. The existing rules and regulations signs are temporary. Some of the signs have been shot up. Signs that have been damaged should be replaced as soon as possible to present an image of active patrol. Old, shot-up signs present an image of a disinterested landowner. Two entrance signs are needed. One should be placed along CSAH 22. Another would be desirable across from the WMA parking lot on the east side of the SNA.

Action # 5	Complete perimeter signing, replace temporary signs with permanent ones.
Action # 6	Erect two entrance signs, one along CSAH 22 and one across from the WMA parking lot.
Action # 7	Erect an information board at the parking area (see action 8).

Site Considerations:

CSAH 22 - This should be the major entrance sign. It will receive the greatest public visibility. It should be placed at a point where the lake is also visible. The main purpose of this sign would be to identify the area. Hopefully this visible announcement will discourage inappropriate uses initiating here (fishing, hunting etc) by bringing the area more into the "public eye". (See also Restoration, Action # 22)

Parking lot - This should be an informational area. The information board should orient the user to the area. Any brochures, maps or visitor registration would be placed here. The largest area of the SNA is accessible from this point. Terrain and vegetation conditions of the SNA have few limitations for visitor use here. There is adequate parking for groups. Public use of this area is low.

Signing Strategy - Work with DNR Engineering to develop on appropriate signing strategy for the SNA.

Access

Some of the unit's interesting features are adjacent to the perimeter roads. This lends itself to a drive-and-stop, drive-and-stop use pattern. At no one point is the entire SNA accessible to the visitor. The primary designated parking area will be on the east side of the SNA unit near the WMA wildlife food plot. It is a parking area for the WMA. There are additional areas to pull off along the sand road on the east side. Parking is suitable on the paved shoulder along CSAH 22 and on the west side of the SNA.

Access to the lake outlet along the northern edge of the SNA is restricted in the summer at two points where the boundary crosses a swamp forest. The

logical route for a visitor making their way to the outlet along the northern boundary would be to just skirt the edge of these lowlands. Users arriving at these areas are expected to be destination oriented, rather than exploritory. The level of use is anticipated to be very low.

Action # 8	Designate the parking lot on the east side of the SNA as the primary parking area.

Site Considerations

Use levels - Large members of SNA users are not anticipated in the foreseeable future. However, if this occurs, some road congestion could result, inconveniencing the local residents. The SNA Program will periodically contact some of the local residents and evaluate the appropriateness of this parking area.

Action # 9	a. Seek an agreement with the adjacent landowner on the northern boundary to allow SNA visitors to walk around the low, wet areas.
	b. (alternative). Construct a walkway across wet areas. This would only be practical for the western low area.

Fences

Fencing is not needed anywhere along the perimeter of the SNA except as discussed below. A fence should be constructed along the road by the borrow pit. This is needed to deter vehicle turnaround and general off-road use on the pit and adjacent prairie.

Action # 10	Construct a fence along the road by the borrow pit.

Site Considerations:

Length - It will be approximately 100 yards long, starting from the tree edge on the SW side along the road to where the dry land stops and wet meadow vegetation begins.

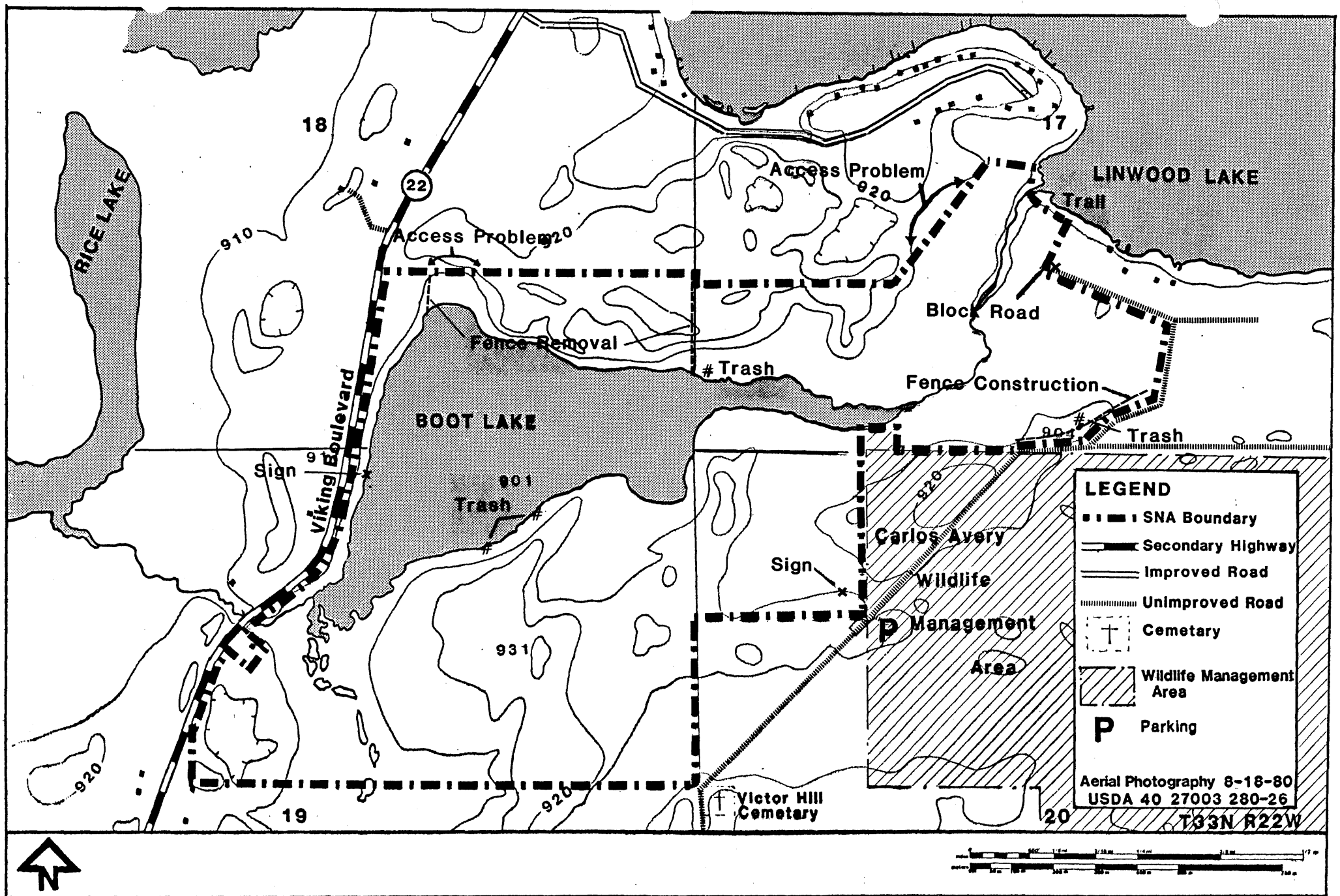
Construction - One segment should be removable (but lockable) to allow vehicle access to the pit for maintenance. (See also Restoration # 21)

Trails

Linwood Lake trail

This trail crosses peat soils poorly suited to trail use in summer. It is presently in poor condition (See visitor activities problem). The trail only minimally facilitates use of the SNA. It is not appropriate to encourage visitor use of this trail. It ends in private property and may result in trespass occurring.

Action # 11	Eliminate trail and bridge.



MAP 2 - General Management

BOOT LAKE SNA

Jack Pine bog trail

This bog is an interesting feature of the SNA. Because of this, visitor use may be concentrated on or around it. The surrounding uplands can sustain this use. The bog is sensitive to trampling. The wetness of the jack pine bog probably deters most visitors from entering. However, if in the future, use intensity increases or present use levels show signs of degrading the site, the area should be protected. Two alternatives are to construct a boardwalk across the bog, or restrict use. The primary objective of any protection measure would be resource protection rather than visitor facilitation.

Action # 12 No trail development proposed for present.

VEGETATION MANAGEMENT

Fire-Upland Forests

There are many different aspects to the questions of using fire as a management tool, and the natural occurrence of fire in the Boot Lake area. Fire was an important, if not dominant environmental factor determining the vegetational composition and structure in areas similar to Boot Lake.
The specific fire history of the SNA is difficult to ascertain. Questions as they relate to the management of Boot Lake include:

What type of fire regime occurred historically?
How is the present vegetation the result of the former fire history?
Is the presence and abundance of northern associated plants (especially ground layer species) related to fire?
What kind of changes are occurring as the result of fire suppression?

Fire can be introduced either as a tool or as a process. At present it appears that the best use of fire would be as a tool to restore areas of oak with a prairie understory; and oak forest with a northern plant species understory.

Action # 13 Burn between the lake and CSAH 22 to stimulate the remaining oak-prairie openings vegetation. Begin with early spring burns. (See also Restoration Action # 22)

Site Considerations:

Existing vegetation - In some places the canopy consists of large, open grown northern pin oak. Some prairie grasses still exist here. The best area like this is at the southwest end of the lake.

Fire control - Existing firebreaks are formed by the road and ditch on the west and the lake on east. A pump truck has easy access from road. Lake makes use of stationary pump practical.

Fire timing - Early spring burns would stimulate the warm season grasses and reduce cool season exotic grasses. The likelihood of having suitable burn conditions is greater in spring than fall.

Visibility - This area has high public visibility. Restoring it to a more natural native community would provide good public exposure to the SNA.

Monitoring - The only monitoring necessary would be a qualitative description of the area prior to management, and field observations on the fires and subsequent changes in vegetation

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Action # 14 Allow for controlled experiments on the effect of fire in upland communities.

Site Considerations:

Northern ground-layer species - Particular attention should be focused on understory species. Objectives of this experimental burn program would include:

Determine effects of fire on understory.
Determine best management approach for maintaining northern ground-layer species.
Identify conflicts between management for northern ground-layer species and other resource objectives.

Monitoring - A thorough pre-burn inventory, monitoring of vegetation response, experimental methods, and control plots is required.

Fire-Prairie

The best occurrence of prairie on the SNA is adjacent to the borrow pit. This area is quite disturbed. It was formerly cultivated. Fire will be used to accomplish the following objectives:

1. Maintain Hieracium longipilum and (if present) Aristida tuberculosa
2. Maintain and stimulate the existing prairie vegetation.
3. Eliminate exotic weeds.
4. Reduce woody encroachment.
5. Restore borrow pit to native vegetation. (See also Restoration, Action # 21).

Action # 15 Burn prairie and borrow pit. Begin with early spring fires. Adjust burn schedule to meet site objectives.

Site Considerations:

Weed control. Kentucky blue grass (Poa pratensis). Early spring fires should provide adequate control.

Yellow fox tail (Setaria glauca). An annual. Should decrease as perennial grasses increase. May increase initially with burning.

Quack grass (Agropyron repens). Should decrease with early spring burning.

Goatsbeard (Tragopogon sp.). Beinnial. Not very abundant. May be resistant to early spring burning. May require hand pulling before it sets seed.

Burn units. Should be at least two. Hieracium should be included in each.

Fire breaks. The road is adequate on the south. A mowed break is needed on the other sides. The area is small enough to use a hand or small riding mower. Fires should extend into young oaks a bit if possible.

Fire frequency. Lack of litter may be a limiting factor in burning frequently for control of exotics.

Borrow pit. At present this area does not have enough litter to carry a fire. (See Restoration, Action 21)

Woody encroachment. Northern pin oak is the dominant invader. Spring burning may reduce its stature, but is not expected to eliminate it.

Monitoring. Qualitative description of: vegetation prior to management highlighting management concerns (e.g exotics, woody encroachment), fire conditions, fire behavior and changes in vegetation. Thorough documentation of Hieracium prior to management and subsequent change.

Fire - Wet Meadow, Shrub Thicket

The use of fire in these communities has been suggested for the benefit of sandhill cranes. Sandhill cranes require large areas of Type II and Type III wetlands. Burning would reduce shrub encroachment and increase the area of wet meadow. Consecutive burns over several seasons would be required to substantially reduce shrub cover. Spring burns would be most practical when snow is still under the trees. It is not clear, however, whether the SNA could ever provide any significant habitat for the local population of sandhill cranes.

Burning some portions of the wet meadow may also be required to establish firebreaks for later planned fires on adjoining uplands.

The wet meadow area in the past has been heavily disturbed. It has been tilled, cropped, planted to reed canary grass and hayed.

Burning should be allowed in the wet meadow and adjacent shrub thicket communities to accomplish various SNA objectives, but it is not needed to preserve these communities.

Action # 16	Burn the wet meadow and shrub thicket communities. (This action is only to be implemented if and when it appears that this would provide an important contribution to the local sandhill crane population.)

Site Considerations

Purple loosestrife - Before any disturbance of these communities takes place an assessment should be made to determine whether these actions might affect the spread of purple loosestrife. If needed, a small test burn should be conducted before the whole area is burned.

Implementation - The SNA Program should cooperate with the Carlos Avery WMA staff in the planning and implementation of a fire management program for sandhill cranes.

Rhamnus spp Control (Buckthorn)

R. cathartica and R. frangula are exotic shrubs that can aggressively invade forested areas. They occur on both upland and lowland sites. Both of these species have been reported in the wet-forested communities. They have not yet been seen on the uplands. Control requires direct application of a herbicide, either to a cut stump or directly on the plant. The optimal time for a control program is fall, after most the other deciduous vegetation has dropped its leaves. Both species of Rhamnus retain their dark green leaves well into fall making them quite conspicuous at this time. Small plants may be pulled out.

Action # 17 Suppress Rhamnus cathartica and Rhamnus frangula where they occur in the SNA.

Site Considerations

Access - Walking through these areas can be difficult because of wetness, density of vegetation (especially shrubs and tamarack) and the presence of poison sumac.

Purple Loosestrife Lythrum salicaria (summarized from Thompson and Stuckey, 1980)

Purple loosestrife is an erect perennial wetland herb that was probably introduced from northern Europe. By the late 1800's it had spread throughout the northeastern United States and southeastern Canada. It poses a serious threat to native emergent vegetation in shallow water marshes throughout the northeastern and northcentral regions.

A common pattern can be seen in the invasion and establishment of purple loosestrife. First, a long lapse of time occurs between the earliest records of local occurence and recognition of loosestrife as a serious problem. This may suggest a period of acclimation or it may be a reflection of the slow spread of the plant from local seed sources. Water borne seeds or propagules are probably responsible for the establishment of serious infestations. Second, stressed or disturbed habitats (e.g. flooding of shallow basins, drainage of deep marshes, seasonal drawdowns) are most susceptible to becoming dominated by purple loosestrife. The key to local eradication is an annual search of the area during July and August to locate established loosestrife plants. Field crews should hand pull all these plants, including the rootcrown. Since purple loosestrife fragments can reproduce vegetatively it is important to carry all pulled material out of the marsh basin. If loosestrife is established and one or more years of seed production has occurred, the opportunity to attempt local eradication has probably been lost. The unit is then vulnerable to heavy infestation.

Any form of disturbance or stress to the native plant community should be avoided. The shaded understories of wetland hardwood forests or shrub thickets will exclude L. salicaria. However, if these stands are flooded they will suffer mortality and loosestrife will become established in openings of the canopy. Purple loosestrife has been reported to occur in Martin Lake and on the Carlos Avery WMA. The mostly likely route of dispersal into Boot Lake would be from the inlet creek or up the outlet creek from Linwood Lake Dispersal of loosestrife seeds however is also possible by birds, beaver, muskrat, minks or turtles.

An infestation of purple loosestrife on the SNA would probably be most serious in the wet meadow and floating mat communities. In particular loosestrife may threaten the water willow (Decadon verticillatus).

Action #18	Survey Boot Lake and surrounding vicinity annually for the presence of purple loosestrife.

Site Considerations

Intensity - Boot Lake should be intensely surveyed for presence of individual plants. The surrounding vicinity need only be surveyed to get a qualitative assessment of presence, extent and spreading rate.

Additional Inventory Needs:

Ram's-head lady's slipper

Situation: Ram's-head lady's slipper (Cypripedium arietinum) has been reported in the past, but no specimen or first-hand account is known.

Action # 19	Search the SNA for the occurrence of Cypripedium arietinum.

Site Considerations

Where - All areas where conifers dominate (bogs and uplands) should be searched.

When - Approximately during the last week in May and the first two weeks in June.

Sea-Beach Triple-Awned Grass

Sea-Beach Triple-Awned Grass (Aristida tuberculosa) has been reported as an element occurring in the borrow pit area. No collection of this species is known to exist. It may well have been misidentified. Aristida basiramea was found to be abundant on the borrow pit prairie in the fall of 1981.

Action #20	Search the borrow-pit area for Aristida tuberculosa.

Site Considerations:

When - Late August through September.

Aquatic Vegetation (See Other Resource Management, Action # 29)

RESTORATION

Borrow pit

Vegetation of the borrow pit is quite sparse. Plants that do occur are predominantly weedy species. In addition to the original removal of sand, the pit is continually disturbed by off-road vehicle use (see Visitor Use, pg). The very disturbed appearance of this area may "invite" inappropriate uses. The west side of the pit has a steep scarp. Directly behind or above, this scarp is the largest concentration of Hieracium on the site. Smoothing this scarp out by scraping the slope back would damage the Hieracium and other existing prairie species.

Little bluestem appears to be recolonizing the eastern pit area to some degree. It is not known to what extent natural recolonization of the pit is limited by past removal of the soil, off-road vehicle use, or other factors.

The proposed method for restoration and revegetation is as follows:

1. Smooth out steep scarps by adding sandy material from the local area. Avoid source areas where sweet clover occurs or has formerly gone to seed.

2. Cut adjacent prairie vegetation to use as mulch and seed source for pit area. Prior to cutting, the prairie should be fertilized. This will increase seed size and germ.

3. Fertilize the pit area.

4. Spade the prairie hay into the pit area.

5. Follow-up a year or so later with an application of fertilizer on the newly established prairie.

This method of fertilization, cutting and spading-in has been used by the Nebraska Department of Transportation in the Sand Hills area of Nebraska.

Action # 21 Restore and revegetate the borrow pit area.

Site Considerations

Fertilization - Response of the existing prairie vegetation to fertilization should be tested initially on a small plot. In particular it should be determined whether fertilization might cause any undesirable changes in species composition, for example, a reduction of Hieracium longipilum. Studies of old field fertilization are currently being conducted at the Cedar Creek Natural History Area by Dr. David Tillman (University of Minnesota). Dr. Tillman should be consulted in designing the fertilization program.

Timing - Fertilization and harvesting of the prairie vegetation should not occur until present weed problems are largely under control. During this period, weeds may become more of a problem in the pit area. The elimination of disturbance from off-road vehicle use (see fencing, Action #10) may contribute to a more stable environment for the weeds. These should be eliminated as best as practical before revegetation begins.

Cutting - The prairie vegetation could be cut by hand with a sythe. The area is too small for agricultural equipment and a lawn mower may cut the material too fine.

CSAH 22.

The boundary of the SNA along CSAH 22 (Viking Blvd.) is highly visible to the public. The roadside is presently dominated by exotics The highway department mows the area one or two cuts wide, once or twice annually.

Between the roadside and the lake is a fringe of trees, predominantly aspen and northern pin oak. In some areas, especially near the southwest corner of the lake, prairie grasses occur in the ground layer under northern pin oak.

Replacing the right-of-way vegetation with prairie grasses would give a distinctive, more natural impression of the SNA to the passing public. Optimally it would better identify the area as a 'natural' area.

Plant material for revegetation would probably be available locally. One suggested method for restoration would be to herbicide the existing vegetation and then interseed with prairie species. By not disrupting the sod no erosion would occur and weed problems would be minimal.

Action # 22 Revegetate the eastern right-of-way along CSAH 22 with prairie species.

Site Considerations

Species - Use a low-stature species assemblege, including grasses like little bluestem, to avoid any road safety conflicts.

Fire - Maintain the area with a prescribed fire schedule once established.

Quality - The major purpose is to achieve "naturalness" in appearance for the general public.

County Highway Department - Inform the Anoka County Highway Department when revegetation and maintenance activities are scheduled. An agreement not to spray or mow the area should be sought.

Old Fields

Old fields (and cultivated fields) occupy greater than 40 acres of the SNA. The two largest, 25 acres and 18 acres, present a major fragmentation of the more natural surrounding vegetation types. The larger western one is under a hay lease. Smooth brome (Bromus inermis) is present in the south half of this field. A browse line is evident along the edges of both fields. Encroaching woody material is browsed by deer and rabbit. Both large fields are surrounded by similar forests and have like soils. Soil types and General Land Office survey notes (1855) suggest that these two areas had some type of woody cover in presettlement times.

The proposed long term goal for these two fields is that they be returned to a condition similar to the surrounding forest. Even though the surrounding forest has been disturbed, a continuous area of this vegetation type will more closely simulate natural conditions, than if the fields were converted to some other vegetation type that may have occurred on the site in the past (eg. savanna, prairie).

The methods to convert an old field to a community like the surrounding one are not clear. The following management approach is proposed:

a. One field be left for succession to occur.

b. On the second large field experiment with a variety of restoration methods.

Over the long term, such a project could aid in comparing the benefits of a restoration effort such as this, to natural succession. Evaluation of the results should particularly emphasize reestablishment of the characteristic understory and ground layers.

Browsing by deer, rabbits and other rodents may affect the results in both situations (see Deer, action # 26). Past liming probably only has a temporary effect on soil pH. Management of the other small old fields within the SNA will be based on results from the two larger fields.

Action # 23 Mark the boundaries of all the fields with a permanent marker such as conduit.

Action # 24

a) Western field (field VI). Discontinue hay lease upon expiration. Eliminate undesirable perennials on 1/2 of the field.

b) Eastern field (field V). Divide the field into compartments and apply a variety of restoration techniques.

Site Considerations:

Western field (field VI)

Brome grass and other perennials - Before this hay field is "allowed" to begin old-field succession, undesirable perennial grasses and weeds such as smooth brome grass should be eliminated on half of the field. Two possible approaches include: keeping the field fallow for at least a year or putting the field in an annual crop. The other half of the field should be left in hay to compare succession between the treated half and the hayfield.

Present condition - Active hayfield

Implementation: DNR Wildlife may be interested in using the one half of the field as a temporary foodplot. This would only be allowed long enough to accomplish restoration objectives. They would consider planting either corn or rye. It should be determined whether deer use of the adjacent forested areas would be adversely impacted by a foodplot (see Deer Action # 25, 26)

Access - This field is less accessible via state owned land than the eastern field.

Eastern Field (field V)

Access - This field has the best access across state owned land. Because of this it has the best potential for long term restoration projects.

Present condition - old-field vegetation

General

Monitoring - Set up a long-term, monitoring system. This should include frequent, low-level monitoring procedures and periodic intensive monitoring.

Design – Some design ideas for restoration approaches should be available from results of fire management in up land forests (Fire, Action # 14).

WILDLIFE MANAGEMENT

Deer

Browsing by white-tailed deer, rabbits and other rodents can have a significant effect on an area's vegetation, including: species abundance, composition, reproduction, and stature. The wintering deer population in the adjacent Carlos Avery WMA is increasing. The wildlife manager has suggested that Boot Lake SNA may become a sanctuary for deer during the fall hunting season and possibly through the winter. To determine how deer and rodent populations affect the SNA requires at least annual population counts and exclosure areas.

If a need to control deer is identified, it appears the only practical method would be a public hunt. The primary effect of such a hunt would be to disturb the deer. The desired result would be that the deer would no longer recognize the SNA as a sanctuary area. The proximity of the SNA to the WMA sanctuary area might add to the effectiveness of this technique. The deer can easily move into the sanctuary from Boot Lake.

Action # 25 Annually survey deer population levels

Site Considerations:

Implementation - DNR Wildlife will include Boot Lake in their aerial deer censusing. This commonly occurs during the winter period.

Action #26 Set up several deer exclosures

Site Considerations

Exclosure design - Design should be such that part of it is deer proof and part deer and rabbit proof.

Location - Exclosures should be put on both upland and lowland sites, and across the field-forest edge.

Timing - Some exclosures could be seasonal, to determine the seasonality of browse pressure.

Priorities - first: uplands, field forest edge, second: lowlands, seasonal

Beaver

Beaver have been reported periodically to build dams across the Boot Lake outlet creek. In the past this has resulted in some complaints about water levels and was suggested as a potential obstruction to the northern pike spawning run (from Linwood Lake, through Boot Lake into Rice Lake). No beaver or recent beaver sign were observed during the fall of 1981 and the winter of

1982. At the present time no resource conflicts between beaver activity and other SNA resources have been identified. If beaver should again become active, no immediate action will be taken. If conflicts arise, these will be mitigated appropriately. Beavers are recognized as a natural component of the Boot Lake area. It is the primary intent of the SNA program to maintain natural conditions. In the local area beavers are relatively abundant.

Action #27 Make annual observations on beaver activity.

Considerations:

Timing - Easiest time to identify an active lodge is between leaf-fall and freeze-up. This can be accomplished very efficiently from the air.

Action #28 Make annual observations on the spring northern pike spawning run.

Considerations:

Location - At culvert under CSAH 22 and at outlet bridge.

Loons

Loons have been reported to nest near the east end of Boot Lake. The Twin Cities metropolitan area is near the southern edge of their breeding range.

Action #29 Make annual observations on loons at Boot Lake.

Site Considerations

Minimum - Record loon presence or absence during the breeding and brood-rearing period.

Additional - Verify nesting occurrences and nesting success.

Non-game Program - Complete an annual report form for the DNR Non-game Program's Cannon Loon Survey

OTHER RESOURCE MANAGEMENT

LAKE

No recent water quality or other data are available on the lake. No monitoring is presently taking place. During the SNA inventory, no physical or biological inventory of the lake was done. Both base line information and long term, low level monitoring would be desirable. Desirable base-line information includes: an inventory of the aqatic plants, chemical analysis of lake water, fish survey of the lake

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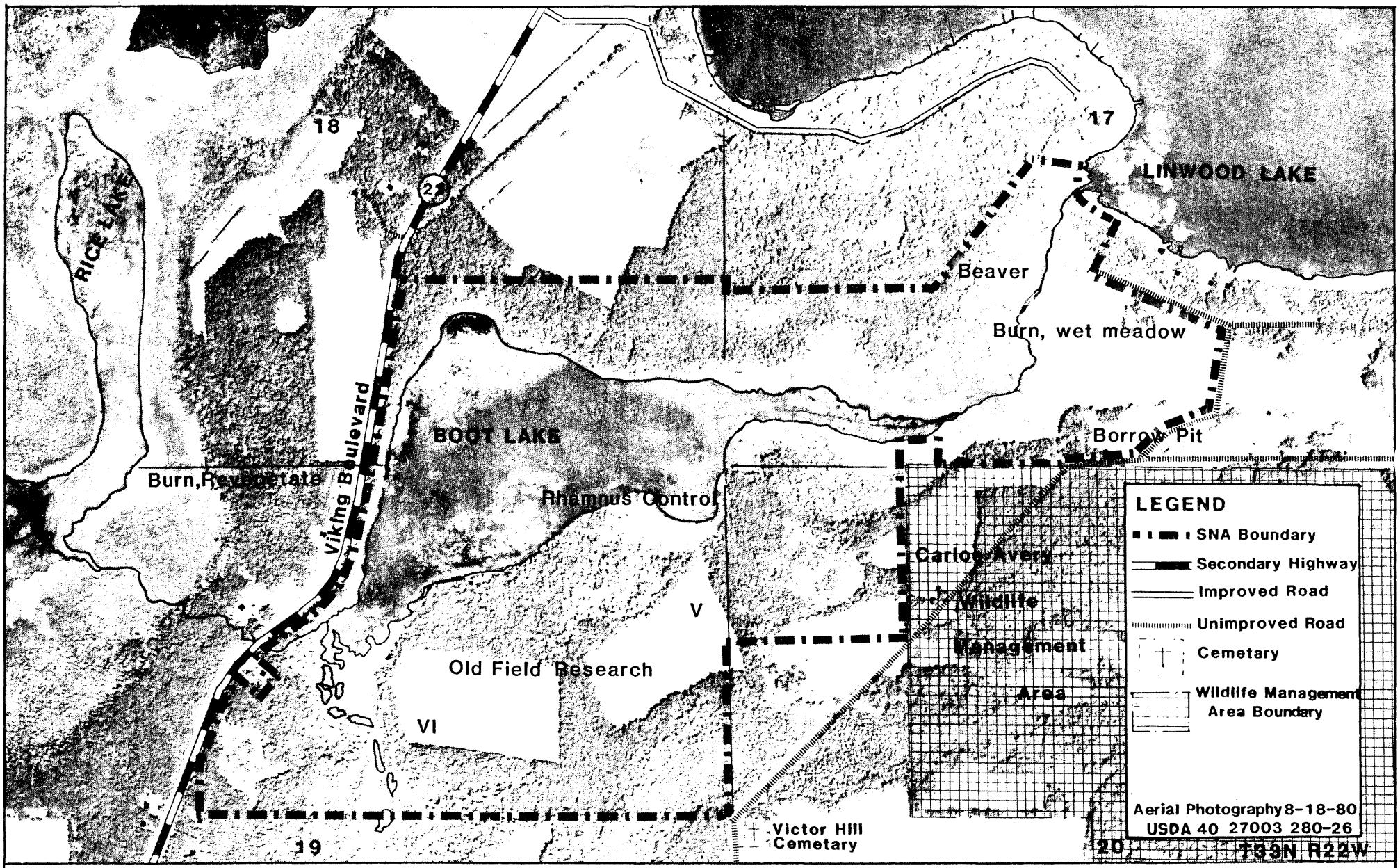
Action # 30 Set up a lake water level gauge.

Site Considerations

Location - Gauge should be close to CSAH 22 for easy observation. A local volunteer or organization should be solicited to make the observations.

Monitoring - For the first year make observations weekly during the ice-free months, monthly during ice-covered period, and following major rains or rainy periods. From the results, design a monitoring schedule that will identify significant features of the lake's water reign.



MAP 3 - Vegetation Management

BOOT LAKE SNA

Gauge - Ice may dislodge a staff gauge. To avoid this a movable sheath should be placed around the gauge. The gauge should also be calibrated with a permanent bench mark on shore.

Action # 31 Make annual observations on the status of:

water willow: during flowering period
wild rice: during ricing season

Action # 32 Inventory aquatic plants of the lake

Site Considerations:

Timing - Late summer is the most practical time to inventory for aquatics. The fruits are often necessary for positive identification.

Action # 33 Conduct a fish survey of the lake.

Site Considerations:

Problem species - Concentrate on evaluating potential problem species such as carp and bullheads. These can have a significant impact on water quality and lake biology. It may be of interest to monitor the roughfish population in a lake closed to fishing. Introduction of non-native species in the watershed should be discouraged if that species has the potential of eventually colonizing Boot Lake.

Action # 34 Conduct a chemical analysis of the lake water.

Site Considerations:

Human impacts - Concentrate on identifying those substances associated with human activity in the watershed.

Action #35 Map and describe the Boot Lake watershed.

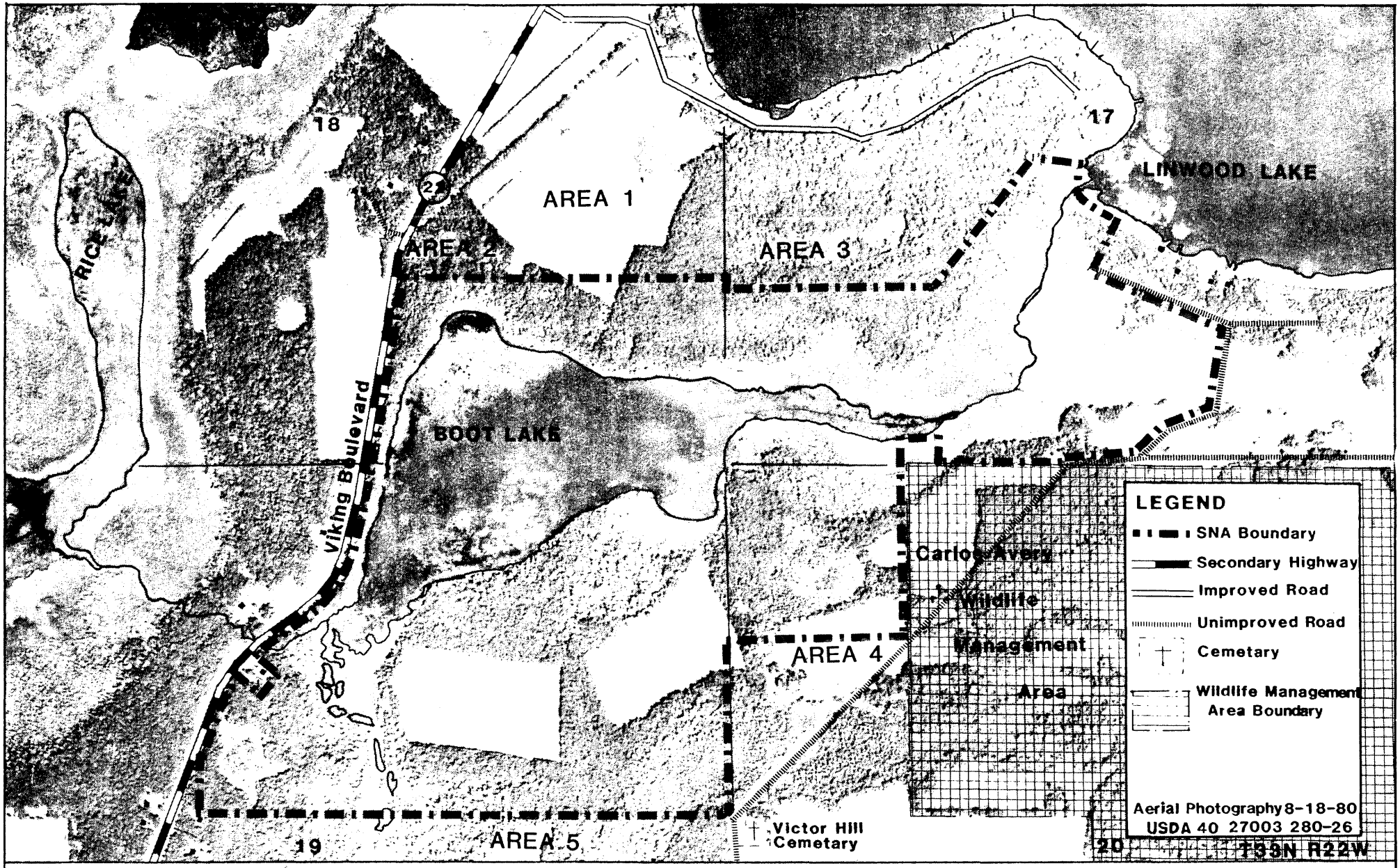
ADJACENT RESOURCES

Several areas adjacent Boot Lake could have a significant impact on the SNA if land-use should change. An area may be important if: 1) its vegetation is contiguous with a similar vegetation type on the SNA, 2) it contains a significant natural element, 3) development would have a strong visual, noise or other impacts on the SNA, or 4) development would hinder management activities. These areas are delineated on map and are discussed below. Suggestions on management of these areas should be discussed with the adjacent landowners.

Area 1

Quality: This area is actively being cultivated. It has no natural features that are important to the preserve.

Threats: There is a potential for residential development, but not in the immediate future.



MAP 4 - Adjacent Resources

BOOT LAKE SNA

Relationship
to the SNA: The strip of upland forest between the lake and Area 1 is quite narrow. Residential development would increase human related activity along this edge of the SNA. This would negatively impact the natural character of the area and may also affect wildlife use. The potential to manage the woods here with fire would also be lowered if houses were built near the property line.

Area 2

Quality: The oak woods in area 2 are contiguous with the woods along the north shore of Boot Lake. Composition is similar. It is an active woodlot. The overstory is more open than on the SNA. A small jack pine bog occurs in this area as well.

Threats: The area has the potential for future residential development. This is not likely in the immediate future. It would require construction of a road. Salvage cutting has take place around the jack-pine bog.

Relationship to the preserve: The strip of oak woods between the lake and the northern boundary of the SNA is quite narrow. This large area of oak woods adjacent to the SNA is probably important for the presence and abundance of several wildlife species on the adjacent SNA. Management activities such as prescribed burning would be more difficult with houses adjacent the property line. The preservation of the jack pine bog would be imporant for comparison with the one already within the SNA, and for the future of this vegetation type in this general area.

1. Leave the jack pine bog undisturbed. Leave a buffer strip of woods around the bog; to include at least the immediate slopes.

2. Do not cut any of the jack pine on the surrounding upland. Even dead ones retain their cones for some time and may provide a seed source.

3. Register the jack pine bog site under The Nature Conservancy's land owner contact program.

Area 3

Quality: This small piece of woods is similar in composition and contiguous with the oak woods in the SNA.

Threats: This area has been surveyed and put up for sale.

Relationship to the preserve: A low area extends from the lake north across the SNA boundary into Area 3. During wet periods crossing this lowland is difficult. Skirting it on dry ground would require crossing onto private property for a short distance. In addition, the area between the lake and the SNA boundary is very narrow of this point. A high amount of activity would negatively impact the SNA. The western boundary of Boot Lake is impacted by CSAH 22 already.

Suggestions

(If developed)

1. Gain an access agreement around the low area so visitors to the SNA will have access to the north shore of the lake.

Area 4

Quality: The old field and homestead have no important natural features. The small strip of woods between the fields has a lot of large white pine. The alder-tamarak forest is contiguous with the same forest type on the SNA.

Threat: There is no immediate threat of development. The current owner plans to retire here.

Relationship to the preserve: The SNA boundary crosses the old field. This is one of the primary access points to the area of the preserve south of Boot Lake. (See signs, action # 5; Access, action # 6). If this land were to be subdivided, visitors to the SNA would have to walk behind the houses. This would be an undesirable situation.

Suggestions

1. Do not subdivide the property NW of the sand road.

2. Discuss the possibilities for a conservation easement on the property.

Area 5

Quality: The upland forest in Area 5 is similar in composition and disturbance history to the oak forest on the SNA. White pine appears to be more abundant. Lowland forest communities are contiguous and similar to the adjacent SNA. One field is included in Area 5.

Threat: Development pressure for the upland sites is high. One owner, Wallace Peterson, has expressed his desire to see the land protected some day.

Relationship to the preserve: Area 5 provides a natural buffer along the southern boundary of the SNA. The lowland areas limit potential housing development over more than 1/2 the southern boundary. These lowlands are contiguous with lowlands on the SNA and are part of the Boot Lake basin. As such, changes in water quality or water levels (e.g. draining, filling, septic system discharge) as a result of changes in surrounding land-use could potentially affect the SNA.

The oaks woods on the uplands are similar in composition and contiguous with the oak woods on the SNA. It would seem likely
that the presence and/or abundance of several wildlife species on the SNA is related to the larger area of available habitat
provided by these surrounding woods. Aquisition of this area by the SNA program cannot be presently justified on the basis of statewide priorities or critical need to the preserve. Some type of preservation of the area however would be desirable.

Suggestions

1. Pursue alternatives for preservation with the current landowners. Some possibilities include fee title public ownership (eg. as an addition to the Carlos Avery WMA), or through a conservation easement.

2. Evaluate the area for registration under The Nature Conservancy's land owner contact program.

(If developed)

2. a. Develop lots adjacent the SNA boundary rather than a road or road end.
   b. Develop large lots adjacent the boundary.
   c. Leave the lowlands undisturbed, leave a wooded buffer strip around the edges to include the immediate slopes.

LOCAL PERSPECTIVE

Linwood Township (The following discussion is summarized from the Linwood Township Comprehensive Plan, 1979)

Boot Lake SNA is located in Linwood Township in the extreme northern fringe of the Metropolitan Area, approximately 40 miles from the Twin Cities. The township is served by Interstate 35 which parallels the eastern boundary. CSAH 22 provides east-west access through Linwood. Within the context of the Twin Cities Metropolitan Area, Linwood Township serves the primary function of providing housing in a rural, open space environment. The general community objectives for Linwood are:

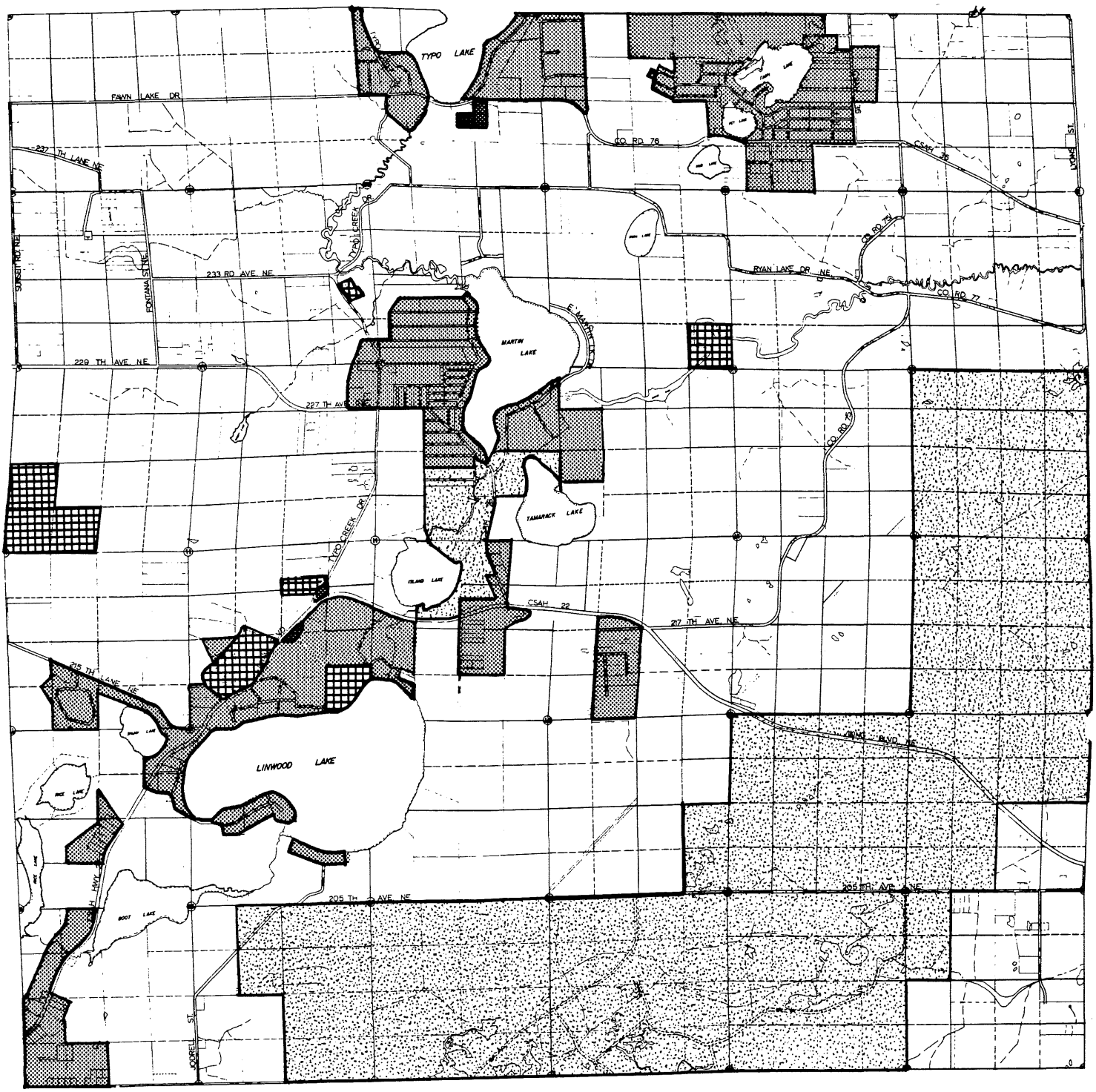
1. Protect, preserve and enhance the community's natural/rural environment avoiding the creation of an 'urban' environment and sustaining the existing low density 'rural' suburban growth pattern.

2. To avoid the creation of an urban environment, growth shall be regulated so that the need for a premature extension of sewer service can be avoided.

Linwood has been experiencing unprecedented growth pressures in recent years. Single family homes are the predominant housing type. Map # 5 shows the land-use development plan for Linwood Township. Map# 6 shows how Linwood plans to direct anticipated growth. The west side of Boot Lake SNA is a primary growth staging area. Residential development and expansion of community services will be focused in this type of area. Minimum lot size is 2 1/2 acres.

The rest of the private land surrounding the SNA is planned a residential/agricultural district. Minimum lot size is 5 acres. This can be appealed to 2.5 acres with proof of adequate soil service capability and evidence that such a development will not result in rapid urbanization.

Local road development could affect the SNA. The new road proposed south of the SNA (see map 7) crosses a lowland area contiguous with the SNA, and also could have an impact on the type of development that would occur adjacent the southern boundary of the SNA (See adjacent resources, Area 5, pg 23).



Residential/Agricultural

Residential

Public Open

Semi Public

Commercial

DEVELOPMENT LAND USE PLAN— MAP 5

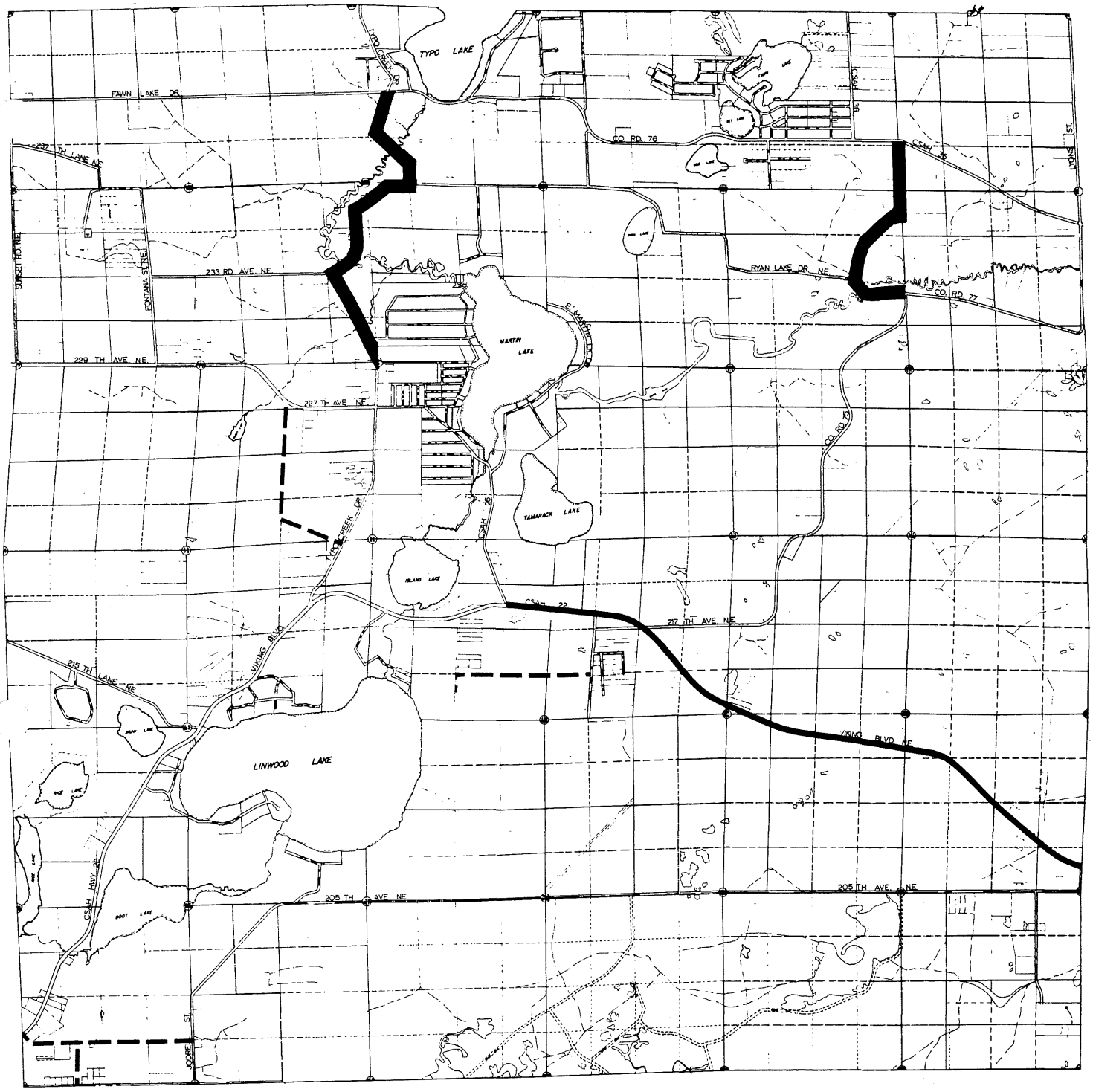
LINWOOD TOWNSHIP

800' 0' 1600' 3200' 1 MI N

This map is for planning purposes only and should not be used when precise measurement is required.

Midwest Planning/Research
urban planning • design • market research

REV. 4-79 VJh



Future roads

Resurfacing

Priority for paving, improvements

Midwest Planning/Research
urban planning • design • market research

TRANSPORTATION PLAN — MAP 7

LINWOOD TOWNSHIP

800' 0' 1600' 3200' 1MI N

VJH 2-79

This map is for planning purposes only and should not be used when precise measurement is required.

Carlos Avery Wildlife Management Area (WMA)

Adjoining the eastern boundary of Boot Lake SNA is the Carlos Avery WMA (21,713 acres). The WMA includes upland woods, lowland forests, old fields, cropland and large wetlands. It was established to provide public hunting for sportsmen in the Twin Cities. It is administered by the DNR, Section of Wildlife. In the past it has been managed principally for waterfowl with secondary emphasis on white tailed deer, squirrels and ruffed grouse and fur-bearers. Hunting and trapping are the dominant recreational uses (DNR, 1977). The management area also provides a variety of other wildlife-oriented outdoor recreation. A large sanctuary area within the WMA occurs just southeast of Boot Lake (see map # **8**).

The WMA headquarters is located about 1 1/2 miles SE of the SNA. Heavy equipment used on the WMA and in the region is stored here. This includes farm equipment, equipment used to construct and maintain roads and firebreaks, manipulate wildlife habitat, build dikes and water control structures.

Prescribed burning has been used extensively on the WMA. It has been applied to the management of wetlands and upland grasslands. Prescribed burning is also planned for savanna areas within the WMA.

The DNR, Division of Forestry maintains its Metro Region headquarters, Carlos Avery District Headquarters and a nursery in the WMA. (See map# **8**)

Martin-Island-Linwood Regional Park

The Metropolitan Council expects this to be a heavily used park when development is completed. It will offer family camping (100 sites) swimming and boating. (see map **9**). A swimming beach, picnic area, nature study area and trails are proposed to be developed in the south end of the park nearest the SNA. Development is scheduled for 1985.

VISITORS AND USE

Past Use

Before SNA designation, public recreational use was confined to Boot Lake itself. The lake was used for both summer and winter fishing, harvesting of wild rice, and snowmobiling. The upland areas were in private ownership. The land on the north and east sides of the lake were leased to a gun club.

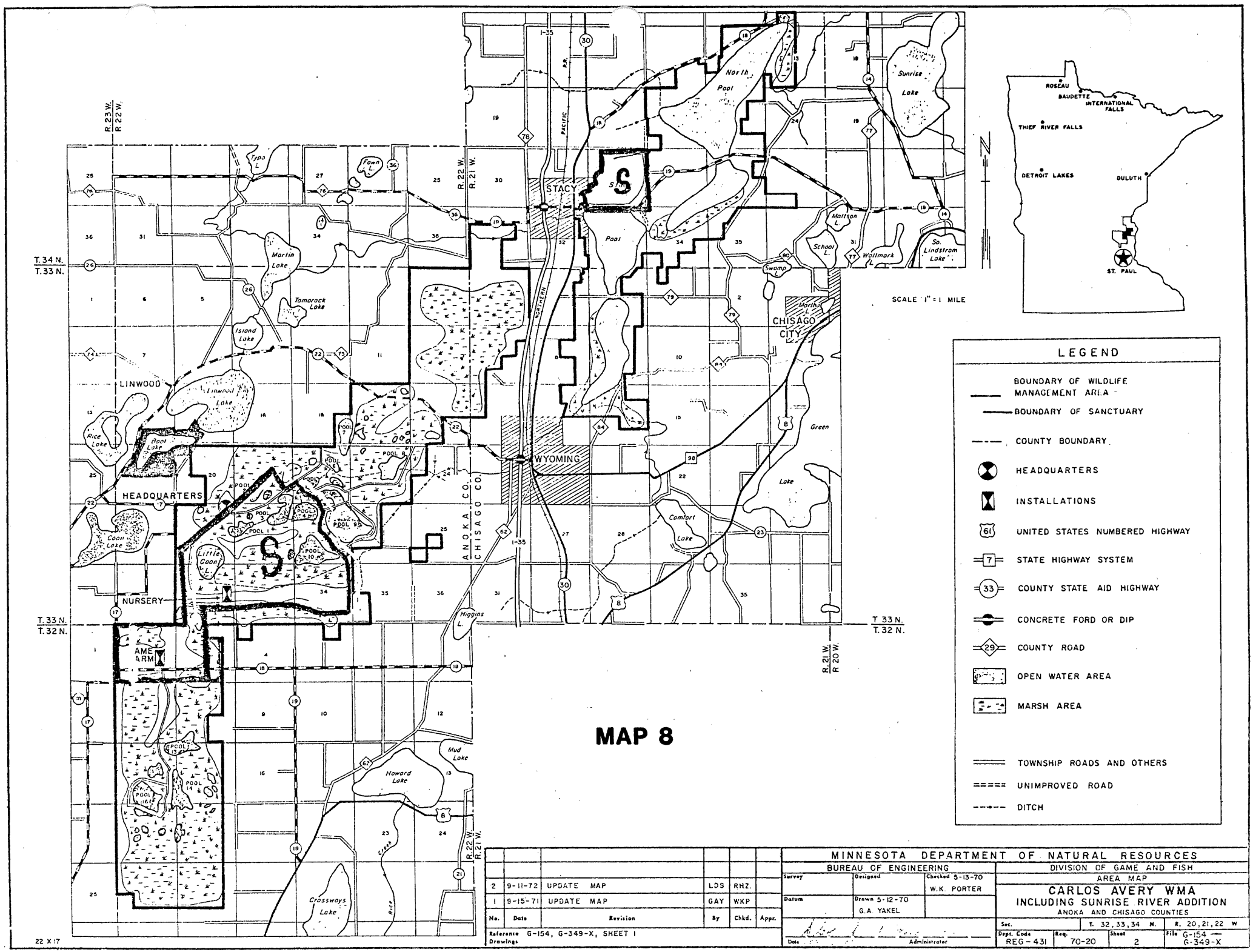
Present Use

Since SNA designation, no effort has been made to gather information on user numbers or characteristics.

Use and Activity Problems

Borrow pit area. The lower part of this area was heavily disturbed by sand removal. The upper portions are dominated by prairie species. The entire area was once a cultivated field. Hieracium longipilum occurs on the upland part.

The area next to the road is commonly used as a vehicle turn-around.



MAP 8

LEGEND

- BOUNDARY OF WILDLIFE MANAGEMENT AREA
- BOUNDARY OF SANCTUARY
- COUNTY BOUNDARY
- HEADQUARTERS
- INSTALLATIONS
- 61 — UNITED STATES NUMBERED HIGHWAY
- 7 — STATE HIGHWAY SYSTEM
- 33 — COUNTY STATE AID HIGHWAY
- CONCRETE FORD OR DIP
- 29 — COUNTY ROAD
- OPEN WATER AREA
- MARSH AREA
- TOWNSHIP ROADS AND OTHERS
- UNIMPROVED ROAD
- DITCH

No.	Date	Revision	By	Chkd.	Appr.
2	9-11-72	UPDATE MAP	LDS	RHZ.	
1	9-15-71	UPDATE MAP	GAY	WKP	

Reference Drawings: G-154, G-349-X, SHEET 1

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
BUREAU OF ENGINEERING
DIVISION OF GAME AND FISH

Survey | Designed | Checked 5-13-70 W.K. PORTER
Datum | Drawn 5-12-70 G.A. YAKEL

Date | Administrator

AREA MAP

CARLOS AVERY WMA
INCLUDING SUNRISE RIVER ADDITION
ANOKA AND CHISAGO COUNTIES

Sec. T. 32, 33, 34 N. R. 20, 21, 22 W

Dept. Code REG-431 | Req. 70-20 | Sheet 2 | File G-154 — G-349-X

22 X 17

MARTIN-ISLAND-LINWOOD LAKE REGIONAL PARK

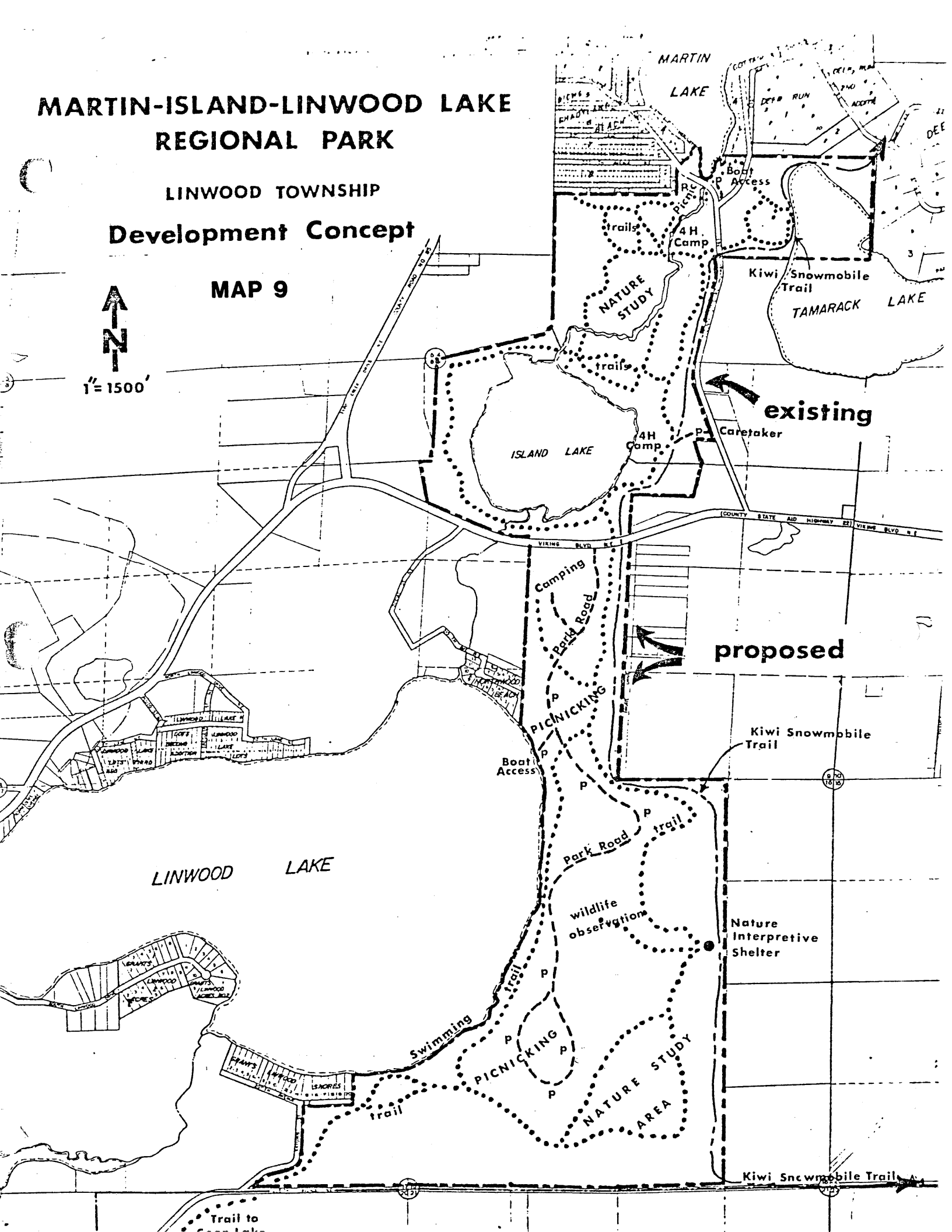
LINWOOD TOWNSHIP

Development Concept

MAP 9

N

1" = 1500'



Tracks indicate vehicles drive all over the lower pit area. Some also drive up onto the upper prairie. The area is also used for target practice and trash dumping.

Wild rice. Wild rice has been traditionally harvested off Boot Lake in the past. The area conservation officer reports that on occasion the lake has been harvested illegally before the season or at night. Further harvesting of the rice is not allowed under SNA policies.

Fishing-Boating. Since designation some fishing or boating has apparently taken place on Boot Lake. A fish house was reported on the lake during the winter of 1980-81. Evidence of a boat being slid into the water from CSAH 22 was also noted fall of 1981.

Boat launching on Linwood Lake. During the summer of 1981 boats were being launched onto Linwood Lake from SNA property. The boats were brought up the trail that starts at the west end of 207th Ave NE. The county has lot #1 of Grants Linwood Shores (adjacent the SNA) for the purposes of public access. This access however has not yet been developed.

Linwood Lake trail. A trail exists along the shore of Linwood Lake between houses on the north side of the Boot Lake outlet and houses on the south. It follows an old road bed. A small bridge across the creek was built by local youths. The trail is situated on peat soils. As mentioned previously, the southeast side of the trail is used for boat access onto Linwood Lake. A small fire ring is present at the landing. The trail is also used by foot traffic and a 3-wheeled ATV. These activities have caused ruts, puddles and loss of ground cover along the trail. With the development of the county park on the east side on Linwood Lake it is expected that use of the trail will increase considerably. Development plans for the county park call for a picnic area and swimming beach near the southeast shore of Linwood Lake (See also Martin, Island, Linwood Regional Park, pg 25).

Snowmobiling. In the past a heavily used snowmobile trail went from E.J's bar south of the SNA across Boot Lake, to Linwood Lake and up to Martin Lake. The last few years prior to 1981-82 have been poor snow seasons. Snowmobile use in general has been low. During the 1981-82 winter snowmobiles have been observed using the south side of Boot Lake in .

Hunting. During the 1981 hunting season there was one report of hunters coming off SNA land onto private adjacent property. The 1981 season was the first year the area had been posted as a "restricted area, no hunting allowed."

Summary of Management Programs

General Management Considerations

Boot Lake will receive a high level of management activity. A local resident will be found to take custodial responsibility for the SNA. He (she) will be the primary contact person for questions that arise about Boot Lake in the local community. Some general trash clean-up will be required on the preserve. Wild fires will be controled, but with a minimum of disturbance to the natural area.

Structures and Facilities

The SNA needs additional perimeter and entrance signs. Access to and within the site is good except along the northern boundary. Here, two access problems exist across low, wet areas. SNA visitors will be informed to use the Carlos Avery WMA parking lot on the east side of the preserve. A fence is needed separating the borrow pit from the sand road.

Vegetation Management

Fire will be the primary management tool used on the SNA. Ground fires will be used to stimulate oak-prairie vegetation and northern ground layer species in the oak forest. A burn management program on the prairie will enhance native vegetation and suppress exotic weeds. Fire may be used in the wet meadow and shrub thicket communities to create sand hill crane nesting habitat. Exotic plants that require special attention and control are Rhamnus spp. (Buckthorn) and purple loosestrife Lythrum salicaria. Additional inventory information is needed on the Ram's head lady's slipper, triple awned grass and the aquatic vegetation of Boot Lake.

Restoration

The borrow pit will be restored to native prairie vegetation. Plant material from the adjoining prairie will be used. The CSAH right-of-way will be converted to a native grassland community. This will enhance and define the general public's image of the SNA. The long term goal of the large fields is to restore them to a condition similar to the surrounding forest. One field will be left for natural succession and a variety of restoration techniques will be tried on the other.

Wildlife Management

White tailed deer may presently be, or may become a management problem in the future. A deer censusing program and exclosures will be set up to determine the impact. Beaver activity will be monitored to identify if they cause any problems for adjacent landowners, or obstruct the northern pike spawning run. Loon activity on Boot Lake will also be observed.

Other Resource Management

Base line information needed on Boot Lake includes an inventory of aquatic plants, a chemical analysis of the lake water, a fish survey and an analysis and description of the watershed. Long term, low level monitoring will be conducted on lake water levels, water willow (Decadon verticillatus), and wild rice.

Adjacent Resources

In the future private land adjacent to the SNA will probably be developed for residential housing. Suggestions are given on how these lands could be developed with a minimal impact on the SNA.

EFFECTS OF MANAGEMENT ON SIGNIFICANT RESOURCES

Plants

Decadon verticillatus (water willow)

1. Beaver (Action #27, pg21): Water level changes as a result of damming will probably not affect the water willow. Indirectly it may affect competition with purple loosestrife (see below).

2. Purple loosestrife (Action #18, pg 16): If purple loosestrife were to invade Boot Lake it may compete directly with water willow. Being at the edge of its range, water willow may be a poor competitor. Purple loosestrife is less aggressive under shaded conditions. If water levels were to rise due to damming, some wetland trees would die. This would increase light intensity on the ground and may give purple loosestrife a better competitive advantage.

Aristida tuberculosa (triple-awned grass; if present)

1. Borrow pit restoration (Action #21 pg 17)

   Burning: A. tuberculosa is reported to have alleopathic properties. Because of this it tends to increase under stable conditions. Fire may "cleanse" the soil of the alleopathic substances and set-back the Aristida. A. tuberculosa is an annual and requires bare soil for establishment. A burn management program may favor perennial, sod-forming grasses. This could indirectly reduce the available habitat for the triple-awned grass.

   Fertilization: It is not known how fertilizer in general, or specific fertilizer mixtures will affect A. tuberculosa. It is suspected that increased nutrient availability will increase competition to the detriment of the triple-awned grass.

Hieracium longipilum (hawkweed)

1. Borrow pit restoration (Action #21 pg 17)

   This plant has habitat requirements similar to Aristida tuberculosa. Except for the alleopathic factor the hawkweed is expected to respond to management in much the same way as Aristida tuberculosa.

Nemopanthus mucronata (mountain holly)

1. Rhamnus control (Action #17, pg 15): Rhamnus spp. could potentially compete with mountain holly for available light and nutrients. Suppression of Rhamnus will be beneficial.

Gaylussaca baccata (huckleberry)

1. Fire, upland forests (Action #14, pg 13): It is not known how huckleberry will respond to fire management. It should be identified and monitored on the experimental sites.

Animals

Grus canadensis (sandhill cranes)

1. Fire-wet meadow, shrub thicket (Action# 15 pg 13): Burn management to reduce woody cover could potentially provide additional habitat for the sandhill crane. The benefits at present appear to be small.

Emydoidea blandingi (Blandings turtle)

1. Borrow pit restoration (Action #21 pg 17): It is not known if any relationship exists between the borrow pit and nesting habitat. It is felt that the proposed management will not adversely affect the turtle.

Communities

Jack pine bog community

1. Fire-upland forests (Action #14, pg 13): The jack pines on the upland surrounding the bog may be an important seed source in the life history of the bog. Loss of these trees due to fire could affect the bog's long-term viability. Spring burns are not likely to damage these mature jack pines. It is not known whether any seedling or sapling jack pines occur in the surrounding woods. These could be damaged by burning. If fire were to accidentally escape into the bog the community could be temporarily, or permanently damaged.

MANAGEMENT COSTS AND IMPLEMENTATION

The following chart illustrates the scheduling of actions described in the text, and the immediate and on-going capital costs of implementation. The scope of this plan covers a ten year period. The plan should be reviewed every five years to evaluate progress, reassess priorities and refine management techniques. Actions listed under the category "Begin Immediately" need immediate attention. "Phase I" is the first five year period. "Phase II" is the second five year period. Implementation of many actions is dependent on availability of materials, equipment and labor. Most major pieces of equipment are available at Carlos Avery WMA. Use of these will require advance planning and coordination with Carlos Avery staff. An action may be initiated sooner than scheduled if circumstances so dictate and earlier scheduled actions will not suffer as a result.

The costs shown here do not include labor, equipment, or equipment operations. It is recommended that the SNA Program hire one or more seasonal workers to implement the plans.

ACTION	BEGIN IMMEDIATELY	PHASE I	PHASE II	COMMENTS
General Management Considerations				
Level of management activity (See text, no management actions)				
Surveillance and enforcement				
Action #1 Develop local public relations		x		on-going. Will begin with the planning process
Action #2 Identify preserve custodian	x			
Clean-up				
Action #3 Clean up trash		x		
Fire protection and control				
Action #4 Arrange joint meeting of local fire protection agencies	x			
Structures and Facilities				
Signs				
Action #5 Complete perimeter signing	$200			
Action #6 Erect two entrance signs		$100		
Action #7 Erect an information board				
Access				
Action #8 Designate parking area		x		
Action #9 a. seek access around wet areas			no cost?	Might require purchase of easement
b. construct walkways across wet area			($500)	Conditional on 2a
Fences				
Action #11 Eliminate Linwood Lk trail	x			
Action #12 Construct trail across jack pine bog		$500)		Conditional upon use

ACTION	BEGIN IMMEDIATELY	PHASE I	PHASE II	COMMENTS
Vegetation Management				
Fire-Upland Forests				
Action # 13 Burn along CSAH 22			x	ongoing
Action #14 Experiment with fire in upland communities		x		ongoing
Fire-Prairie				
Action # 15 Burn prairie adjacent borrow-pit		x		ongoing
Fire-Wet Meadow, Shrub Thicket				
Action # 16' Burn wet meadow, shrub thicket communities		(x)		conditional on need
Rhamnus spp. Control				
Action # 17 Suppress Rhamnus spp.		$100/yr		ongoing
Purple loosestrife Control				
Action # 18' Survey annually for loosestrife	x			ongoing
Additional Inventory Needs				
Action # 19 Search for Ram's Head Lady's Slipper		x		
Action # 20 Search for Aristida tuberculosa		x		

ACTION	BEGIN IMMEDIATELY	PHASE I	PHASE II	COMMENTS
Restoration				
Borrow Pit				
Action #21 Restore borrow pit			$300	Cost for fertilizing the adjacent prairie and borrow-pit area does not include the fill.
CSAH 22				
Action #22 Revegetate right-of-way			$450	Can be done in steps if necessary, cost does not include seed, includes equip. operation.
Old Fields				
Action #23 Permanently mark boundaries		$100		
Action #24a. Restore western field		$700		Monitoring is ongoing, cost includes equipment operations
b. Restore eastern field			Costs not yet determined	Monitoring is ongoing, costs? implementation in stages
Wildlife Management				
Deer				
Action #25 Annually survey population	x			ongoing
Action #26 Set up exclosures		$500/excl.		Monitoring is ongoing
Beaver				
Action #27' Annually observe beaver activity		x		ongoing
Action #28" Annually observe northern spawning run		x		ongoing
Loon				
Action #29'' Annually observe loons		x		ongoing

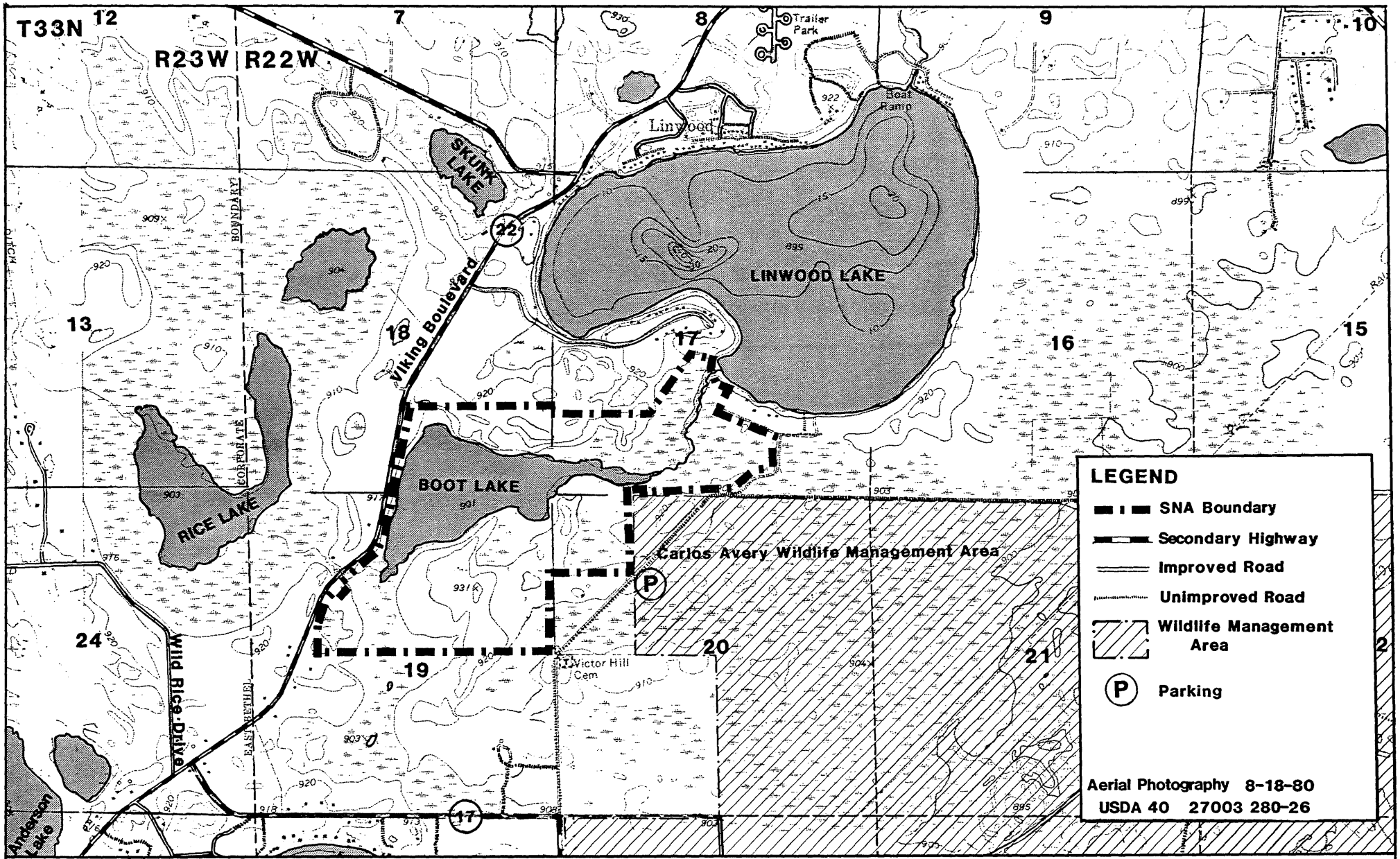
ACTION	BEGIN IMMEDIATELY	PHASE I	PHASE II	COMMENTS
Other Resource Management				
Lake				
Action # 30 Set up lake water level gauge		$100		Monitoring ongoing
Action # 31a. Annually observe waterwillow		x		ongoing
b. Annually observe wildrice		x		ongoing
Action # 32 Inventory aquatic plants		x		
Action # 33 Conduct fish survey		x		
Action # 34 Conduct water chemistry analysis		x		
Action # 35 Map and describe watershed		x		
Adjacent Resources				
See text				Communications should be opened with the adjacent landowners as soon as possible.
Labor				
2 seasonal workers @ 2-4 wks/yr		$1500 - $3000		Effort will taper down to 1-2 wks/yr

The 1979 Resource Inventory for Boot Lake Natural Area Anoka County, Minnesota

Section 17, 18, 19, 20,
Township 33 North, Range 22 West
Coon Lake Beach and Linwood Quadrangles

Prepared by
The Scientific and Natural Areas Section
Division of Parks and Recreation
Minnesota Department of Natural Resources

December 1979 Draft



VICINITY MAP

BOOT LAKE SNA

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Support provided through the State of Minnesota's Legislative Commission on Minnesota Resources.

INTRODUCTION

Scope and Organization

This report documents the information collected during a 1979 inventory of Boot Lake natural area. The inventory recorded information on climate, geology, soils, hydrology, plant communities, flora, birds, mammals, amphibians, reptiles, and land use history. Data supplied by this document will be used by the Minnesota Natural Heritage Program and other evlauators to assess the site as a potential Scientific and Natural Area (SNA). The document can also be used by scientists, educators, and others interested in the area. Should the site be designated an SNA, management plans can be written using this document as a reference.

This report is divided into five sections including: introduction, abiotic, vegetational, and zoological components, and land use history of the site. Methodologies and results are presented for each section.

The inventory of Boot Lake was part of a larger 1979 effort in which eighteen natural areas in east central, northwest, and southeast Minnesota were surveyed. Inventory team members were: John Borowske, SNA Planning Coordinator: Cherry Keller, Karen Lustig, Deb Schowalter, and Jeff Weigel, Researcher/Writers; Kathy Bolin, Community Specialist; and Nancy Berlin, Tony Busche, Barbara Eikum, Peter Farrell, Joanne Herman, Laura Hill, Susan Ottoson, Deanna Schmidt, Marianne Severson, Angela Tornes, and James Ziegler, Researchers. Gerald Jensen, Coordinator, Scientific and Natural Areas

Program, and Mark Heitlinger, Coordinator of Preserve Management, The Nature Conservancy, Minnesota Chapter served as inventory advisors. Michael Rees, Project Editor, The Nature Conservancy, provided editorial assistance. Other individuals who assisted in the preparation of the inventory are mentioned in the appropriate sections. Their help is gratefully acknowledged.

Description of Study Area

Boot Lake natural area is a 400 acre unit in northeastern Anoka County, approximately 18 miles southeast of Cambridge, Minnesota. The area's climate is mid-continental, relatively cool and moist, with warm summers and cold winters. The basin of Boot Lake was formed from the melting of an ice block located in a preglacial valley. It is part of a long string of similarly formed lake basins in Anoka County. Wooded areas of various elevation surround a lake with floating mat, emergent vegetation, and open water zones at the site. A small creek southwest of the tract drains into Boot Lake proper, which empties to the northeast through a chain of lakes leading to the Sunrise River. Sandy mineral and mucky organic soils formed under deciduous forest and wetland vegetation on Boot Lake natural area. Present vegetation is primarily dry to wet deciduous and coniferous forest, with wet meadow, bog, shrub, and various aquatic communities also present. About 43 acres were formerly cultivated and now support old field vegetation.

The flora and fauna of Boot Lake represent a diverse assortment of natural communities. Species observed on the tract include: 319 vascular

plants, 72 birds, 11 mammals, 7 amphibians,and 6 reptiles. The natural area lies within a corn, soybean, oats, and hay farming area, although wetness prevents extensive agriculture. Land use at Boot Lake has included logging, grazing, haying, row cropping, homesteading, and other activities.

Preliminary Assessment of Significance

This section lists features identified by the Minnesota Natural Heritage Program (MNHP) as potential elements[1], and identifies other aspects of the preserve believed by the authors to be important components of Minnesota's natural diversity, or which otherwise might qualify the site for SNA designation. Criteria for SNA evaluation are enumerated in "Minnesota Department of Natural Resources Policy Plan for Scientific and Natural Areas", dated July 6, 1979.

Boot Lake natural area supports a diverse array of flora in a noteworthy succession of vegetation types. The preserve is significant geologically as part of a chain of ice-block basin lakes lying in a subglacially formed feature called a tunnel valley. A continuum of plant communities is found, from the emergent vegetation and floating mats bordering the lake, to wet meadows, shrub thickets, and wet forests in low areas, through the oak forest found on driest upland sites. Long Bearded Hawkweed (Hieracium longipilum) and Sea-Beach Triple-Awned Grass (Aristida tuberculosa), listed as potential plant elements of state sig-

1 An element is a natural feature of particular interest because it is exemplary, unique, threatened, or endangered on a national or statewide basis.

nificance by the Minnesota Natural Heritage Program, occur on the site.

Oak forest, covering 32% of the tract, is representative of one type of original vegetation occurring in this area, as described by Marschner (1930). Marschner's "oak openings", consisting primarily of scattered Bur Oak (Quercus macrocarpa) with prairie understory, has succeeded to an oak forest due to cessation of fire in the area (Curtis, 1959). On Boot Lake's sandy soils, Pin Oak (Q. ellipsoidalis) and White Oak (Q. alba), rather than Bur Oak are present.

The lowland vegetation at Boot Lake includes a combination of northern and southern species. Typical northern species such as Tamarack (Larix laricina), Red Maple (Acer rubrum), and Starflower (Trientalis borealis) are mixed in wet forest communities with typical southern plants such as Poison Sumac (Rhus vernix) and Huckleberry (Gaylussacia baccata). These lowland communities are representative of Marschner's "conifer bogs and swamps", as interpreted by Heinselman (1974). At Boot Lake they are dominated by species such as Tamarack, Red Maple, Paper Birch (Betula papyrifera), Speckled Alder (Alnus rugosa), White Pine (Pinus strobus), and Jack Pine (P. banksiana). An unusual lowland bog type found at the site consists of Jack Pine overstory, with Sphagnum (Sphagnum sp.) and various ericaceous shrubs dominating the herb layer.

ABIOTIC FACTORS

The abiotic resources of an area provide a framework necessary to the existence of all life. The role of physical factors, involving processes of climate, geology, soils, and water is important in ecology. Biotic characters such as range, distribution, and diversity of plant and animal life are ultimately determined by potential limiting factors of the physical environment. These factors must be considered in any analysis of the biota of a natural area.

The natural diversity of an area must be assessed in terms of abiotic as well as biotic elements. Unique physical characteristics, such as influential hydrologic conditions or landforms illustrating geologic processes contribute to overall diversity. The preservation value of a particular area may rest wholly on its abiotic features. The following sections describing climate, geology, soils, and hydrology are an effort to describe the abiotic setting of Boot Lake natural area.

CLIMATE

Methods

Climatological data were gathered by researching National Oceanic and Atmospheric Administration (NOAA), Minnesota Agricultural Experiment Station, and Soil Conservation Service reports. Most numerical data were obtained from the NOAA station at Cambridge, approximately 18 miles north of Boot Lake natural area.

Regional Climate

The climate of east central Minnesota is typical of areas in the central part of the North American continent. Sharp seasonal contrasts in temperature and precipitation result from a lack of moderating factors, such as location near a large body of water. During summer months, southerly winds carry warm, moist air masses northward from the Gulf of Mexico, making summer the season of greatest precipitation. During winter, cold air masses invade from the north, making the winter months cold and dry.

Discussion

The mean temperature for June, July, and August in the Boot Lake area is 68° F; the December, January, and February mean is 13° F. On the average, there are 14 days above 90° F. in the summer and about 45 days below 0° F. in the winter. The average duration of the freeze-free season is 140 days. The length of the total crop season, which includes the growing period for both cool and warm season species, averages 210 days (Baker and Strub, 1963b).

Table 1 Selected Weather Data for Cambridge.

TEMPERATURE	°F	°C
Mean annual temperature	42.0	5.6
Highest temperature recorded (14 July 1936)	109	42.8
Lowest temperature recorded (1 January 1935)	-42	-41.1
Mean temperature warmest month		
Month: July		
Mean daily maximum	81.1	27.3
Mean daily minimum	59.0	15.0
Mean temperature coldest month		
Month: January	8.5	-13.1
Mean daily maximum	18.4	-7.6
Mean daily minimum	-1.4	-18.6
Average date last freeze (Spring)[a]	c. 7 May	
Average date first freeze (Fall)[b]	c. 1 Oct.	
Average days freeze freeze season[c]	140	
Average days total crop season[d]	210	

PRECIPITATION	in.	cm.
Mean annual precipitation	28.47	72.3
Mean precipitation wettest Month		
Month: June	4.77	12.1
Mean precipitation driest month		
Month: January	0.69	1.7
Mean annual snowfall	42.4	107.7
Mean snowfall heaviest month		
Month: December	9.3	23.6

[a]Based on Figure 3. Baker, D. G., and J. H. Strub, Jr. 1963a. Climate of Minnesota: Part I. Probability of Occurrence in Spring and Fall of Selected Low Temperatures. Minnesota Agr. Exp. Sta. Tech. Bull. 243.

[b]Based on Figure 4. Baker and Strub, 1963a.

[c]Based on Figure 16. Baker, D. G., and J. H. Strub, Jr. 1963b. Climate of Minnesota: Part II. The Agricultural and Minimum-Temperature-Free Seasons. Minnesota Agr. Exp. Tech. Bull. 245.

[d]Based on Figure 14. Baker, D.G., and J. H. Strub, Jr. 1963b. Climate of Minnesota: Part II. The Agricultural and Minimum-Temperature-Free Season Minnesota Agr. Exp. Sta. Tech. Bull. 245.

About 80%, or more than 21 inches, of the area's annual precipitation (water equivalent) falls during the period of April through September. June is the wettest month, with numerous thunderstorms accounting for an average of 4.8 total inches of rain. There are about 36 thunderstorms per year. Rainfall intensities of 2.3 inches per day every year, 4.1 inches per day every ten years, and 5.2 inches per day every 50 years are expected to occur. The precipitation during the winter months usually falls as snow, with an average seasonal total of 42 inches. About 100 days a year have a ground snow cover of 1 inch or more. Precipitation of 0.01 inch or more can be expected about 110 days a year in the area. Total annual precipitation about equals total annual evaporation in the area. Prevailing winds blow from the west and northwest during the winter, and from the south and southeast during the summer.

Damaging storms such as severe blizzards, tornadoes and ice storms occur infrequently in the area. The occurrence of ice storms averages less than once per year. However, heavy rains, winds, and hail associated with thunderstorm squall lines occur each year. Table 1 is a summary of selected climate data for the Cambridge area.

Sources of Information

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GEOLOGY

Methods

Geologic information was primarily obtained through a literature search. Field observations using topographic maps and aerial photos aided in interpretation.

Historical Geology

Glaciation during the past two million years (the Pleistocene Epoch) has dominated development of the landscape of Minnesota. The most recent ice advances of the Wisconsin Stage of glaciation are responsible for the majority of the state's landforms. The Superior lobe and the Grantsburg sublobe of the Des Moines lobe covered the Boot Lake area at different times during the Wisconsin Stage. Both left characteristic deposits of glacial drift.

About 20,000 B.P. (years before present; Wright, 1972), the Superior lobe advanced southwestward out of a lowland now occupied by Lake Superior; it extended about as far south as the Twin Cities area. This lobe left deposits of sandy, reddish, noncalcareous glacial drift. A large drift deposit called the St. Croix end moraine was formed at the Superior lobe ice front. A number of other geomorphic features were formed by the Superior lobe, including drumlins, eskers, and tunnel valleys. Of these, only tunnel valleys are found near the natural area. Tunnel valleys developed during wastage of the Superior lobe when subglacial streams fed by basal meltwaters eroded gorges in the material underlying the ice. These valleys are as much as half a mile wide, 200 feet deep, and 100 miles long (Wright, 1972), although burial by younger drift has reduced

their size in many cases. The topographic position of many present day lakes and streams, including Boot Lake, are a direct result of the locations of tunnel valleys.

Following recession of the Superior lobe, a tongue of ice called the Grantsburg sublobe of the Des Moines lobe pushed northeastward over the St. Croix moraine and into the Boot Lake area. This sublobe eventually advanced across east central Minnesota to a terminus near Grantsburg, Wisconsin about 16,000 B.P. (Wright, 1972). The Grantsburg sublobe diverted Glacial Mississippi River drainage northeastward around the ice front and into the St. Croix River valley. Mississippi and St. Croix waters combined with Grantsburg sublobe meltwaters to form a large proglacial lake, Glacial Lake Grantsburg, to the north of Boot Lake. Further wastage of stagnant Grantsburg ice opened channels which drained the lake; however, meltwaters and Mississippi waters continued to flow on and around the ice front. These waters deposited a series of coalescing sandy outwash fans over east central Minnesota until the Grantsburg sublobe disintegrated completely. Eventually the Mississippi broke through the St. Croix moraine near Minneapolis and established its modern course. The large glaciofluvial deposit left behind by the Mississippi and Grantsburg sublobe waters is called the Anoka Sandplain.

Calcareous, grey, silty drift was left by the Grantsburg sublobe, in contrast to the older, red sandy Superior material also found in the area. The Grantsburg outwash buried stagnant ice blocks of both Superior and Grantsburg ice. Many of these ice blocks were left in Superior lobe tunnel valleys; they eventually melted to form chains of ice block lake basins in outwash. Boot Lake is part of such an ice block lake

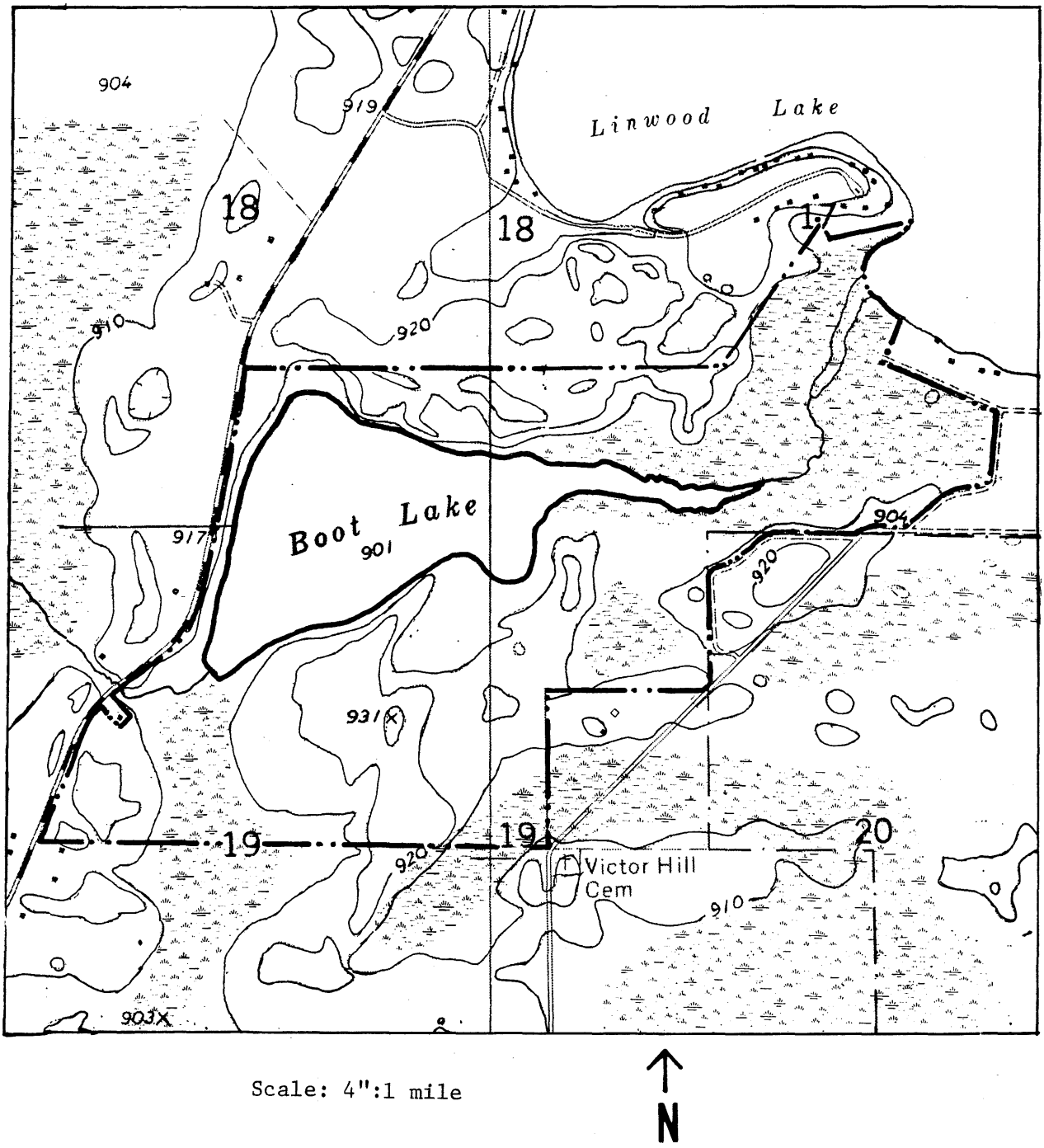

Figure 1. Topography of Boot Lake Natural Area. Adapted from U.S. Geological Survey, Coon Lake Beach and Linwood MN Quadrangles (1:24,000) 1955, 1974.

basin chain localized by a tunnel valley, which also includes Fawn, Martin, Linwood, Coon, and Ham Lakes in Anoka County (Zumberge, 1952).

Topography and Bedrock

Boot Lake natural area lies within the relatively flat, but smoothly undulating Anoka Sandplain. Maximum relief on the site is approximately 30 feet, with the surface of the lake mapped at 901 feet and the highest land elevation at about 930 feet above sea level (see Figure 1). About half of the tract consists of Boot Lake proper and associated depressional wet areas; the remainder is composed of drier uplands. The most prominent relief feature is fairly steep 20 - 25 foot high slope on the north edge of the lake.

East central Minnesota is underlain by various Paleozoic sedimentary rocks deposited from marine seas that covered southeastern Minnesota during Late Cambrian and Early and Middle Ordovician times (approximately 570 to 450 million years ago; Bray, 1977). These rocks, predominantly sandstones and shales about 700 feet thick, were laid down during a series of transgressions and regressions in a shallow branch of the Cambrian and Ordovician seas called the Hollendale Embayment (Sims & Morey, 1972). They are overlain by deposits of glacial drift approximately 150 feet thick near the natural area (USGS, 1974). Precambrian basalts, rhyolites, sandstones, and shales underlie the sedimentary rocks in east central Minnesota.

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SOILS

Methods

Soil information was obtained from literature sources and from the Anoka County Soil Survey manual. Soil series descriptions are based on single sheet soil interpretations provided by the Soil Conservation Service (SCS).[1]

Soils of Boot Lake Natural Area

Boot Lake natural area lies in an area of coarse to medium textured forest soils formed from glacial outwash and peat soils formed from organic matter (Arneman, 1963). The site's mineral soils formed in outwash sands associated with the Grantsburg glacial sublobe (see Geology section). One soil association and five soil series are present on the tract.

The Zimmerman-Isanti-Lino soil association (SCS, 1977) occupies about half of Anoka County. It is found in broad, undulating, sandy outwash plain area. Drainage patterns range from excessive in elevated sand dune areas to very poor in wet depressional sites. Soil development is poor in easily eroded sandy areas. Mineral soils occupy moderate to well drained sites, with mucky and peaty organic soils found in poorly drained areas. The water table is at or near the surface in most depressions.

Soils of the Rifle (typic borohemists) and Seeleyville (typic borosaprists) series are histosols, characterized as cool region soils with a

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1 Bill Vidrine, District Conservationist, SCS, Anoka, provided valuable help for this section.

Key to Table 2.

TEXTURE: Relative proportions of various soil separates (silt, sand, clay) in a soil.
Topsoil: "surface soil", in uncultivated soils, a depth of 3 or 4 to 8 or 10 inches; in agriculture, refers to the layer of soil moved in cultivation.
Subsoil: soil below the top soil, from 8 or 10 to 10 to 60 inches.

DRAINAGE CLASS: Soil drainage refers to natural frequency and duration of saturation which exists during soil development. Soil drainage classes are those used in making detailed soil maps (Arneman and Rust, 1975; USDA-SCS and Minnesota Agricultural Experiment Station, 1977).

ED - Excessively Drained - water is removed very rapidly. Soils are without mottles.
SED - Somewhat Excessively Drained - water is removed rapidly and soils are without mottles.
WD - Well Drained - water is removed from soil readily but not rapidly. Soils are nearly free of mottling.
MWD - Moderately Well Drained - water table usually below 5 feet. Soils are wet for small but significant part of time. Mottling in lower B horizon.
SPD - Somewhat Poorly Drained - water table at depths of 36 to 60 inches. Soil is wet for significant periods, commonly with mottles below 6 to 16 inches.
PD - Poorly Drained - water table seasonally near surface for prolonged intervals. Water table from 18 to 36 inches. Soils wet for long periods, generally with mottles.
VPD - Very Poorly Drained - water table remains at or near surface (above 18 inches) greater part of time. Soils wet nearly all the time, with or without mottling.

COMPONENT IN STATE: Extent of acreage in state.

M - Major: 100,000 acres or more
I - Intermediate: 10,000 to 100,000 acres
m - Minor: 10,000 acres or less.

LOCATION IN STATE:

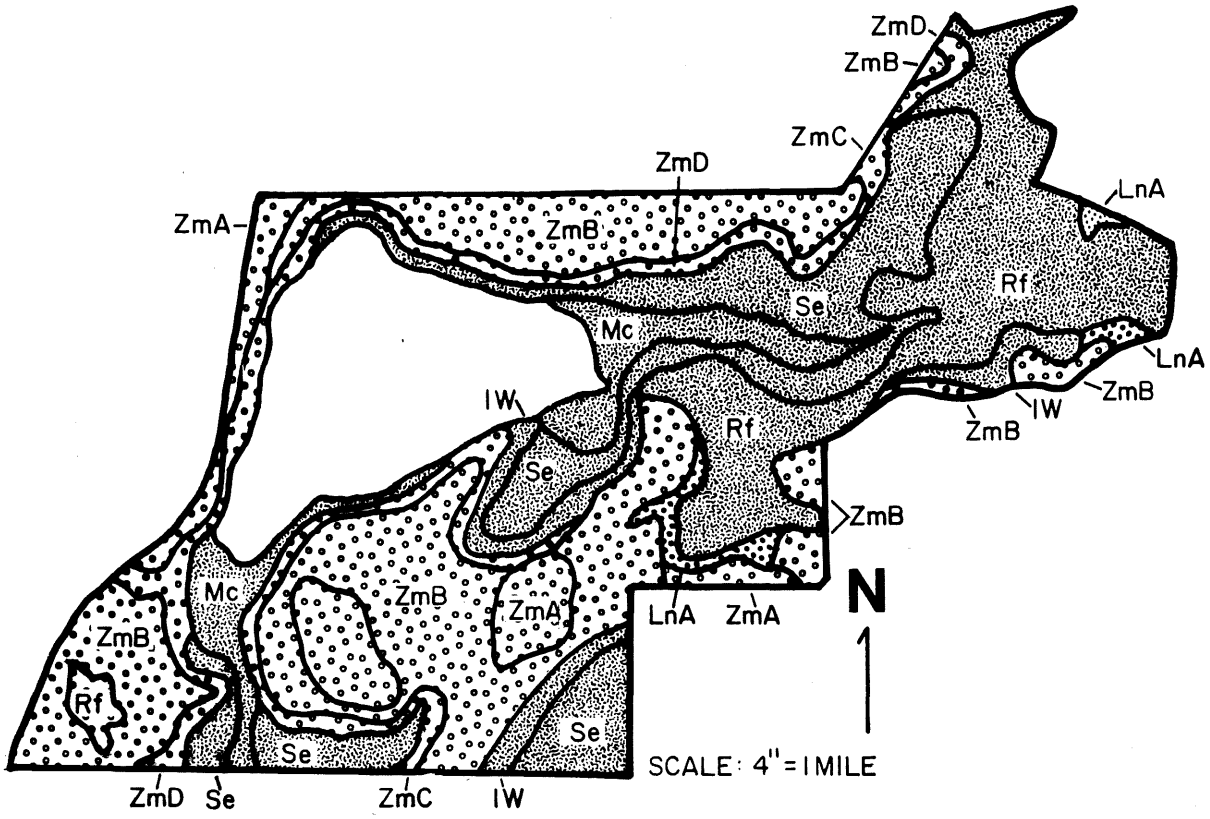
N - Northern
C - Central
NW - Northwestern

Table 2. Soil Characteristics of Boot Lake Natural Area.

SOIL SERIES # ACRES PERCENT	DRAINAGE CLASS	DEPTH TO WATER TABLE	PARENT MATERIAL	LANDSCAPE POSITION	TEXTURE		VEGETATION		COMPONENT IN STATE	LOCATION IN STATE
					TOPSOIL	SUBSOIL	ORIGINAL	PRESENT		
Zimmerman (Zm)	ED	76.0	Outwash sands	broad outwash areas and drainageway escarpments 0-24% slopes	fine sand	fine sand	mixed oak forest		M	C
Lino (LnA)	SPD	2.0'-4.0'	outwash sands	small drainage-ways and low broad flats on outwash plains 0-4% slopes	loamy fine sand	fine sand	deciduous forest		M	C
Isanti (Iw)	VPD	0-2.0'	outwash sands	depressions, drainageways, and low flats on outwash plains 0-2% slopes	fine sandy loam	fine sand	grasses, sedges, and willows		M	C
Seeleyville (Se)	VPD	0-1.0'	organic material	bogs in outwash and till plains	muck	muck	sedges, grasses, and scattered trees		M	NW, N, & C

Table 2 (continued). Soil Characteristics of Boot Lake Natural Area.

SOIL SERIES # ACRES PERCENT	DRAINAGE CLASS	DEPTH TO WATER TABLE	PARENT MATERIAL	LANDSCAPE POSITION	TEXTURE		VEGETATION		COMPONENT IN STATE	LOCATION IN STATE
					TOPSOIL	SUBSOIL	ORIGINAL	PRESENT		
Rifle (Rf)	VPD	0-1.0'	organic material	bogs in outwash plains and moraines 0-1% slopes	mucky peat	mucky peat	reeds, sedges, cattails, and scattered trees		M	NW, N, & C
Marsh (Mc)	VPD	0-5.0' above soil level	variable	depressional areas	unclassified	unclassified	cattails, reeds, and sedges		M	statewide



KEY

DRAINAGE SYMBOL	DRAINAGE CLASS	SOIL SERIES	MAP SYMBOL
	Excessively Drained	Zimmerman	ZmA ZmB ZmC ZmD
	Somewhat Poorly Drained	Lino	LnA
	Very Poorly Drained	Isanti	IW
		Seelyville	Se
		Rifle	Rf
		Marsh	Mc

Figure 2. Boot Lake Natural Area's soil and drainage classes.

surface horizon of greater than 30% organic matter to a depth of 16 inches. Both are very poorly drained soils occupying wet boggy areas at Boot Lake preserve. The organic matter of Rifle soils is only partially decomposed, with plant fiber material still easily visible. Seeleyville soils are more highly decomposed, and are slightly drier. Isanti series (typic haplaquolls) are very poorly drained, seasonally wet soils occupying small depressional areas. However, they are found in slightly better drained, relatively higher positions than Rifle and Seeleyville soils. Horizon formation is minimal and surface layers are strongly acidic in Isanti soils.

Lino (aquic udipsamments) and Zimmerman (alfic udipsamments) series soils are entisols, or recently formed soils displaying little horizon development. Both are characterized as sandy textured, easily weathered mineral soils. Lino soils are wetter and more poorly drained because they occupy topographically lower positions than Zimmerman soils. Boot Lakes' Zimmerman series soils vary greatly in slope, ranging from level to 24%. Steep areas of this series are subject to wind erosion.

Sources of Information

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HYDROLOGY

Methods

Hydrologic conditions of the site were investigated using soil and topographic maps, aerial photographs, and literature sources. Field observations were also used in determining relief and drainage patterns.

Hydrology of Boot Lake Natural Area

Past geologic events associated with the most recent ice advances of the Wisconsin Stage of glaciation are primarily responsible for the hydrologic conditions present at the Boot Lake natural area today. As part of a large glaciofluvial deposit called the Anoka Sandplain, the tract is in a region with a relatively high water table which commonly intersects the surface in depressional areas. The sandy nature of the Anoka Sandplain deposits and the soils formed in them dictate the flow patterns of both surface and subsurface waters at the site.

Boot Lake is fairly shallow 92 acre lake. It is mostly shallower than 5 feet, with a single small depression with a maximum depth of 19 feet (Moyle, 1976). Some areas of the lake are filled with emergent vegetation such as Wild Rice (Zizania aquatica). A small intermittent stream flows into Boot Lake from Rice Lake to the west. A larger stream drains the lake northeastward into a series of lakes and streams eventually emptying into the Sunrise and St. Croix rivers. About half of the natural area consists of Boot Lake and surrounding wetlands; the remainder is composed of better drained uplands.

The natural area's location in a negative relief feature called a tunnel valley (see Geology section) results in a water table at or very

near the surface. Peat deposits are common in poorly drained areas of the Anoka Sandplain such as these. Upland portions of the tract are excessively drained and generally quite dry because of the sandiness of the soils present. These soils are capable of absorbing large amounts of water quickly; thus, the potential for surface runoff is low (SCS, 1975).

Boot Lake natural area is located in the lower St. Croix River watershed. Ground water flows generally eastward towards the deeply entrenched St. Croix River valley (USGS, 1974).

Sources of Information

Eng, Morris T. 1978. An Evaluation of Surficial Geology and Peat Bogs in Anoka, Isanti, and Chisago Counties, Minnesota. Map: (1:125,000) Minnesota Department of Natural Resources, St. Paul.

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VEGETATIONAL COMPONENTS

Plants and plant communities are a major part of the ecosystems present on a natural area. Vegetation reflects the combined influence of all physical factors, and provides the primary energy source for all other living organisms. A description of the flora provides information on the natural area's diversity, as well as an understanding of the origin and recent history of the vegetation. An inventory of vegetational components was conducted to: 1) document the area's species diversity and communities, 2) obtain baseline data so changes can be discerned, and 3) identify rare, sensitive, or representative species and communities.

VEGETATIVE COMMUNITIES

Methods

Vegetative communities were mapped and described according to their cover type. Vegetation maps were produced by delineating major communities visible on aerial photographs. Recent color infrared and/or black and white photographs were used. Communities were described by walking through the area and recording the dominant (i.e., most abundant) species present based on visual estimation. It should be noted that all variations in vegetation were not distinguished on the map. Rather, major types are separated and variations within each type are discussed in the text.

Releves were conducted on selected communities to supplement field inspection and provide further information on species composition. Visual estimates were made of the abundance (% cover) of each species found in a prescribed plot. Plot locations were chosen to represent homogenous stands of vegetation within a community type. Releves were conducted in mid-July and late August according to the methods described by Heitlinger (1979). All releve data is given in Appendix 1.

Photo points were established to give a visual description of vegetation, and to allow documentation of any future changes. All photo point slides are on file, Scientific and Natural Areas Section, St. Paul, and the Nature Conservancy, Minneapolis Field Office.

Overview of Regional Plant Communities

Boot Lake natural area is located on the eastern edge of the Mississippi River Sandplains (Fig. 3). Prior to European settlement, this area consisted of oak openings and barrens and conifer bogs and swamps, with areas of wet prairie, marshes and sloughs (Marschner, 1930; Fig. 4).

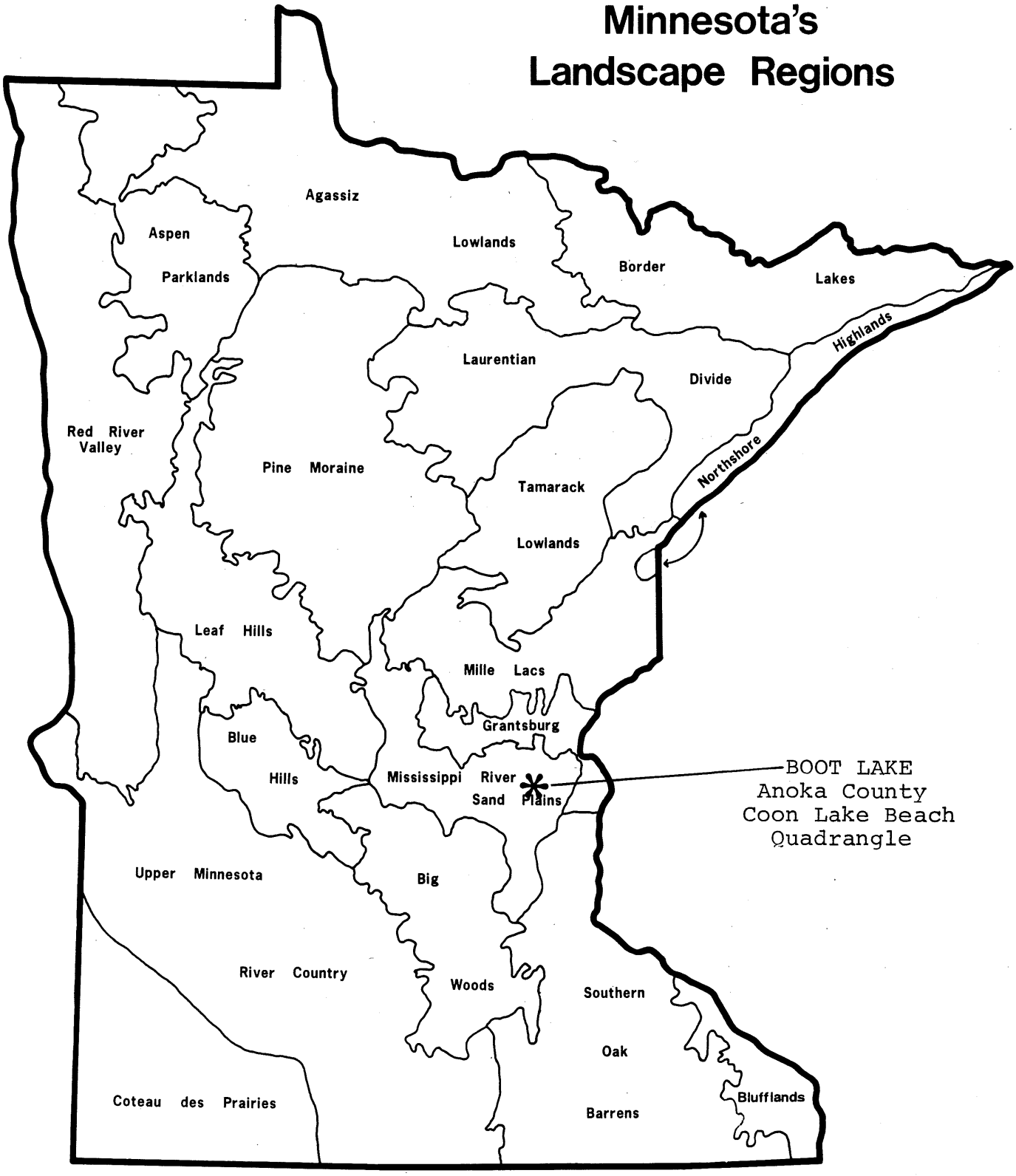


Figure 3. Boot Lake Natural Area in relation ot Minnesota's landscape regions. Adapted from T. Kratz and G.L. Jensen, an ecological geographic division of Minnesota (Unpublished, 1977).

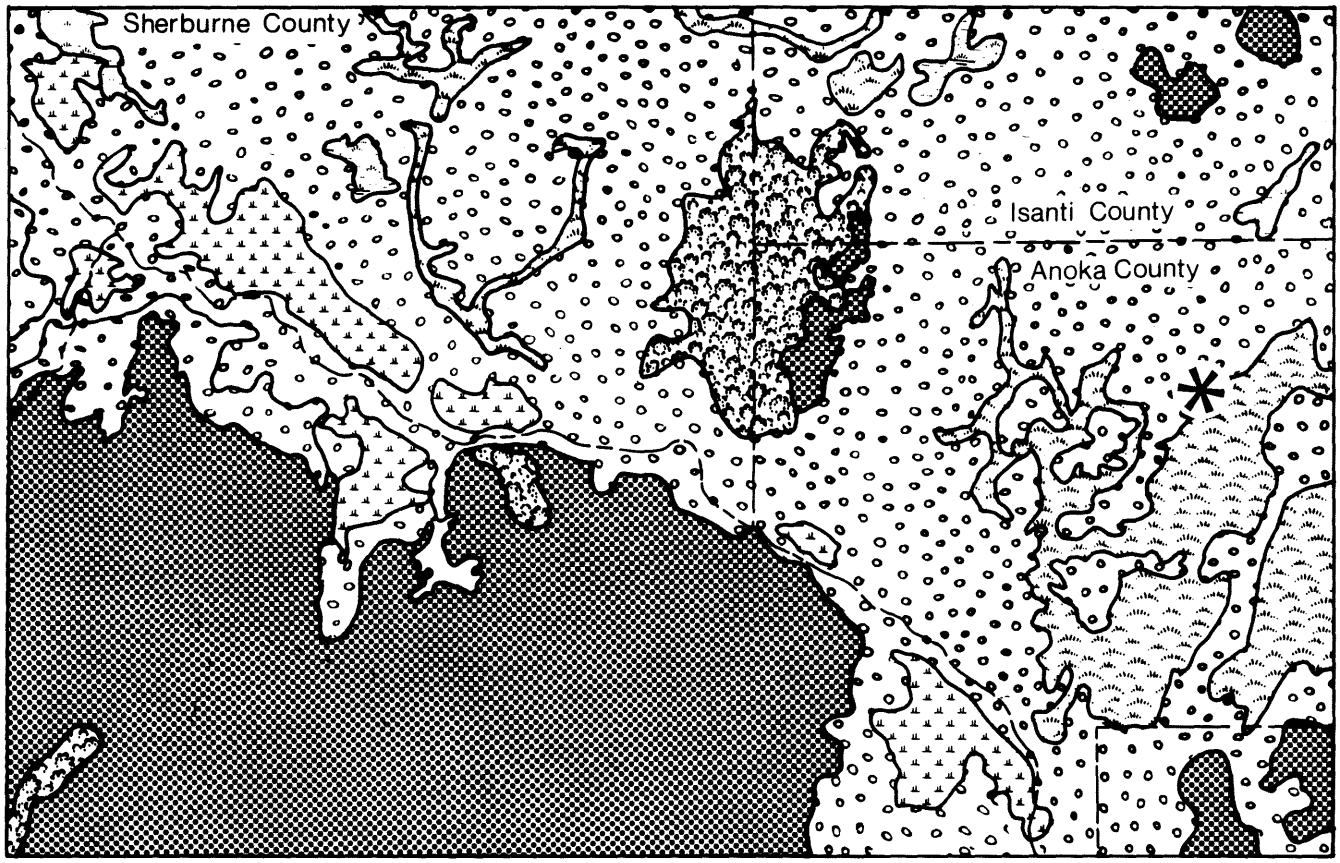


Figure 4. The original vegetation of east-central Minnesota, including Boot Lake. Adapted from F.J. Marschner, The Original Vegetation of Minnesota, 1:500,000.

With European settlement fires were reduced and oak openings were replaced by oak forests on land not utilized for farming. However, examples of the original vegetation can still be found on the tract today.

Results

Boot Lake natural area's community types are illustrated in Figure 5. The area contains several different communities which are situated according to a moisture gradient. The communities range from drier oak forests and fields, to the mixed conifer-hardwood wet forests, conifer bogs, shrubs thickets, wet meadows, and emergent aquatic vegetation. The mixed conifer-hardwood wet forests can be further subdivided into six cover types by examining their dominant overstory trees species. A description of each community is given below.

OAK FOREST: 104 acres, 32% of preserve.

Dominant overstory species are Northern Pin Oak (Quercus ellipsoidalis) and White Oak (Quercus alba). Common shrubs are Smooth Juneberry (Amelanchier laevis), Black Cherry (Prunus serotina), and Red Maple (Acer rubrum). Dominant herbs are Large Leaf Aster (Aster macrophyllus), Pennsylvania Sedge (Carex pennsylvannia), and Bracken Fern (Pteridium aquilinum).

White Pine (Pinus strobus), and Paper Birch (Betula papyrifera) also occur in the overstory. Source of information: field inspection and releve BL-1 and 4.

TAMARACK-ELM-BIRCH WET FOREST: 37 acres, 12% of preserve.

Dominant trees are Tamarack (Larix laricina), American Elm (Ulmus americana), and Paper Birch (Betula papyrifera). Common shrubs include Red Osier Dogwood (Cornus stolonifera). Royal Fern (Osmunda regalis) and Sensitive Fern (Onoclea sensiblis) are common in the ground layer. Source of information: field inspection.

FLOATING MAT/EMERGENTS: 37 acres, 12% of preserve.

These communities occur along the shoreline of Boot Lake. Where the vegetation is thick enough, a floating mat is formed. Dominant species are cattails (Typha), Sphagnum Moss (Sphagnum sp.), Swamp Cinquefoil. (Potentilla palustris), Arrow-Leaved Tear-Thumb (Polygonum sagittatum). Speckled Alder (Alnus rugosa) occurs in small thickets on the floating mat.

Emergent vegetation includes the following species: Reed Canary Grass (Phalaris arundinacea), Wild Rice (Zizania aquatica), Bluejoint Grass (Calamagrostis canadensis), and Water Willow (Decodon verticillatus). Sweet-Scented White Water Lily (Nymphaea tuberosa) is also common. Source of information: field inspection.

CULTIVATED FIELD: 25 acres, 8% of preserve.

This area has been planted with alfalfa (Medicago sativa). Source of information: field inspection.

WET MEADOW: 18 acres, 6% of preserve.

The area is dominated by sedge species (Carex) and Reed Canary Grass (Phalaris arundinacea). The sedges often grow in tussocks. Source of information: field inspection.

OLD FIELD: 18 acres, 6% of preserve.

Dominant grasses are Quack Grass (Agropyron repens) and Rough Bent Grass (Agrostis scabra). Dominant forbs are Field Sorrel (Rumex acetosella) and Hairy Vetch (Vicia villosa).

Numerous Pocket Gopher holes occur in the old fields. Source of information: field inspection and releve BL-2.

TAMARACK-WHITE PINE WET FOREST: 18 acres, 6% of preserve.

Dominate trees are Tamarack (Larix laricina) and White Pine (Pinus strobus). Other common woody plants are Black Alder (Ilex verticillata) and

Mountain Holly (Nemopanthus mucronatus). Sphagnum Moss (Sphagnum sp.), Three Way Sedge (Dulichium arundinaceum), and Cinnamon Fern (Osmunda cinnamomea) dominate the ground cover, especially in areas close to the lake. Source of information: field inspection and releve BL-7.

MAPLE-BIRCH WET FOREST: 17 acres, 5% of preserve.

Red Maple (Acer rubrum), Paper Birch (Betula papyrifera), and White Pine (Pinus strobus) are the dominant overstory trees. Shrubs such as Pagoda Dogwood (Cornus alternifolia), Poison Sumac (Rhus vernix), and Speckled Alder (Alnus rugosa) are common in the understory layer. Cinnamon Fern (Osmunda cinnamonea) dominates the ground cover. Source of information: field inspection and releve BL-10.

SHRUB THICKET: 15 acres, 5% of preserve.

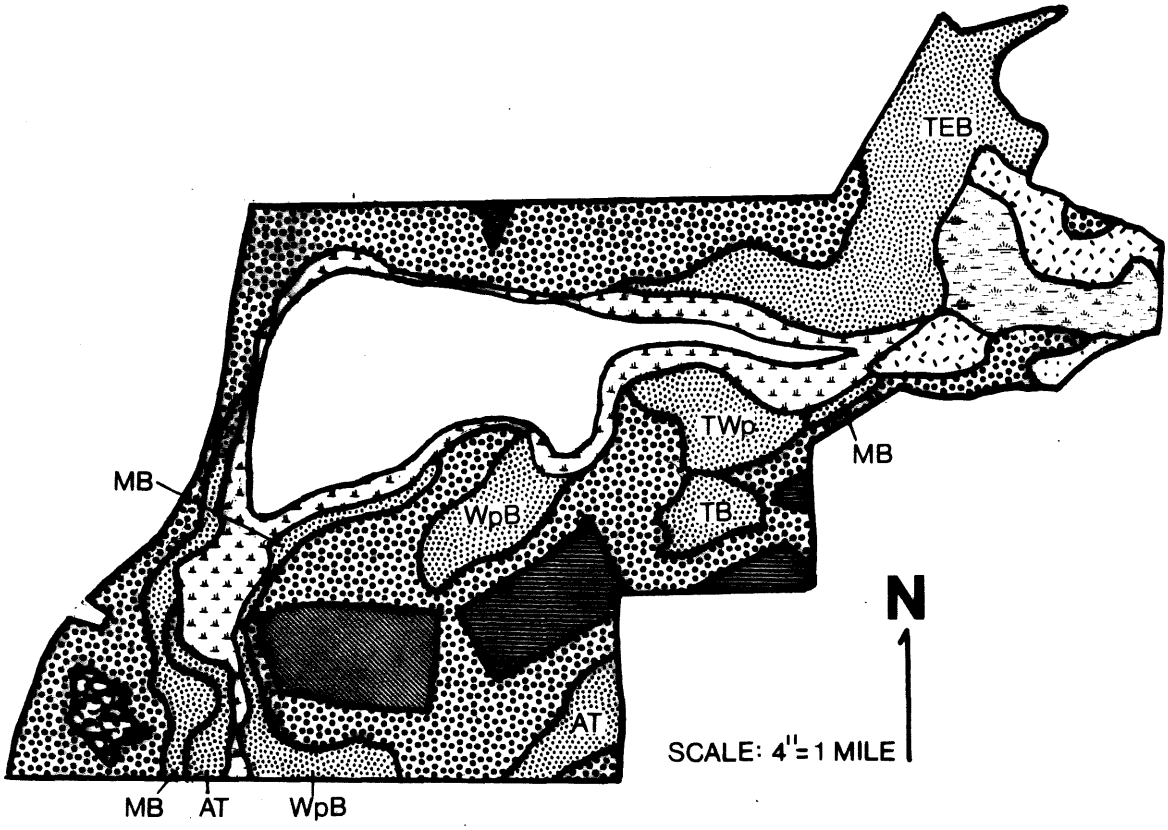
Dominant shrubs are Red Osier Dogwood (Cornus stolonifera) and several willow species (Salix sp.). The ground cover is composed of a variety of herbs, including Reed Canary Grass (Phalaris arundinacea), Fowl Manna Grass (Glyceria striata), and Royal Fern (Osmunda regalis). Source of information: field inspection and releve BL-6.

ALDER-TAMARACK WET FOREST: 14 acres, 4% of preserve.

This area is dominated by Speckled Alder (Alnus rugosa). Tamarack (Larix laricina) and Paper Birch (Betula papyrifera) are common woody species. Dominant ground cover species are Sedge (Carex lacustris) and Sphagnum Moss (Sphagnum sp.). Source of information: field inspection and releve BL-3.

WHITE PINE-BIRCH WET FOREST: 13 acres, 4% of preserve.

White Pine (Pinus strobus) and Paper Birch (Betula papyrifera) are the dominant overstory species. Red Maple (Acer rubrum) is also common.



KEY

	Oak Forest		Shrub Thicket
TEB	Tamarack-Elm-Birch Wet Forest		Old Field
TWp	Tamarack-White Pine Wet Forest		Cultivated Field
MB	Maple-Birch Wet Forest		Clearing
AT	Alder-Tamarack Wet Forest		Wet Meadow
WpB	White Pine-Birch Wet Forest		Floating Mat/Emergents
TB	Tamarack-Birch Wet Forest		Water (Open)
	Jack Pine Bog		

Figure 5. Vegetation communities identified on Boot Lake.

Speckled Alder (Alnus rugosa) is common in the shrub layer. Common herbacious plants include Cinnamon Fern (Osmunda cinnamonea), Royal Fern (Osmunda regalis), and Sensitive Fern (Onoclea sensiblis). Source of information: field inspection.

TAMARACK-BIRCH WET FOREST: 9 acres, 3% of preserve.

Tamarack (Larix laricina) and Paper Birch (Betula papyrifera) dominate the overstory. Black Alder (Ilex verticillatas) and Narrow-Leaved Blueberry (Vaccinium angustifolium) are common shrubs. Sphagnum Moss (Sphagnum sp.) dominates the ground cover.

The Tamarck-Birch community intergrades into a small area dominated by Sphagnum Moss and ericaceous shrubs such as Leather-Leaf (Chamaedaphne calyculata) and Labrador Tea (Ledum groenlandicum). A majority of the Paper Birch trees appeared to be diseased or dying in late August. Source of information: field inspection and releve BL-8.

JACK PINE BOG: 5 acres, 1% of preserve.

Jack Pine (Pinus banksiana) dominates the overstory with Speckled Alder (Alnus rugosa) in the lower height classes. Common shrubs include Leather-Leaf (Chamaedaphne calyculata) and Bog Rosemary (Andromeda glaucophylla). Sphagnum Moss (Sphagnum sp.) and Tall Cotton Grass (Eriophorum angustifolium) dominate the ground layer.

The Jack Pine bog is surrounded by a "moat" dominated by Fowl Manna Grass (Glyceria striata) and Blue-Joint Grass (Calamagrostis canadensis). Source of information: field inspection and releve BL-9.

CLEARINGS: 2 acres, 1% of preserve.

Dominant grasses are Kentucky Blue Grass (Poa pratensis), Little Bluestem (Andropogon scoparius), Big Bluestem (Andropogon gerardi), and Field Sorrel (Rumex acetosella). Source of information: field inspection and releve BL-5.

Sources of Information

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FLORA

Methods

Boot Lake natural area was visited on a weekly basis, when weather conditions permitted, from 27 April to 14 September, 1979. Flowering or fruiting plants were collected and pressed. Habitat, associated species, and collection date was recorded for all specimens. Locations of specimens were indicated on an aerial photograph of the area, or grid field map.[1] Specimens were deposited at the University of Minnesota Herbarium, Botany Department, St. Paul.

A phenological record of the flowering plants was also kept. The recording began on the first visit to the area and ended on the last visit.

Plants were identified using several references (cited at the end of this section). John W. Moore, retired Associate Scientist, University of Minnesota, identified 37 specimens. Gerald Wheeler, identified all species of the genus Carex. Dr. Gerald Ownbey, Curator of the Herbarium Univeristy of Minnesota, verified the remaining specimens. Any specimens identified in the field but not collected, are indicated in the list. Specimens identified by other individuals but not collected are filed with the SNA section.

Plants were designated alien if described as "introduced" in north-eastern United States by both Fernald (1950) and Gleason and Cronquist (1963). Plants were designated possibly alien if described as "introduced" by one of these authorities and native by the other.

1 On file, Scientific and Natural Areas Section, St. Paul, Minnesota.

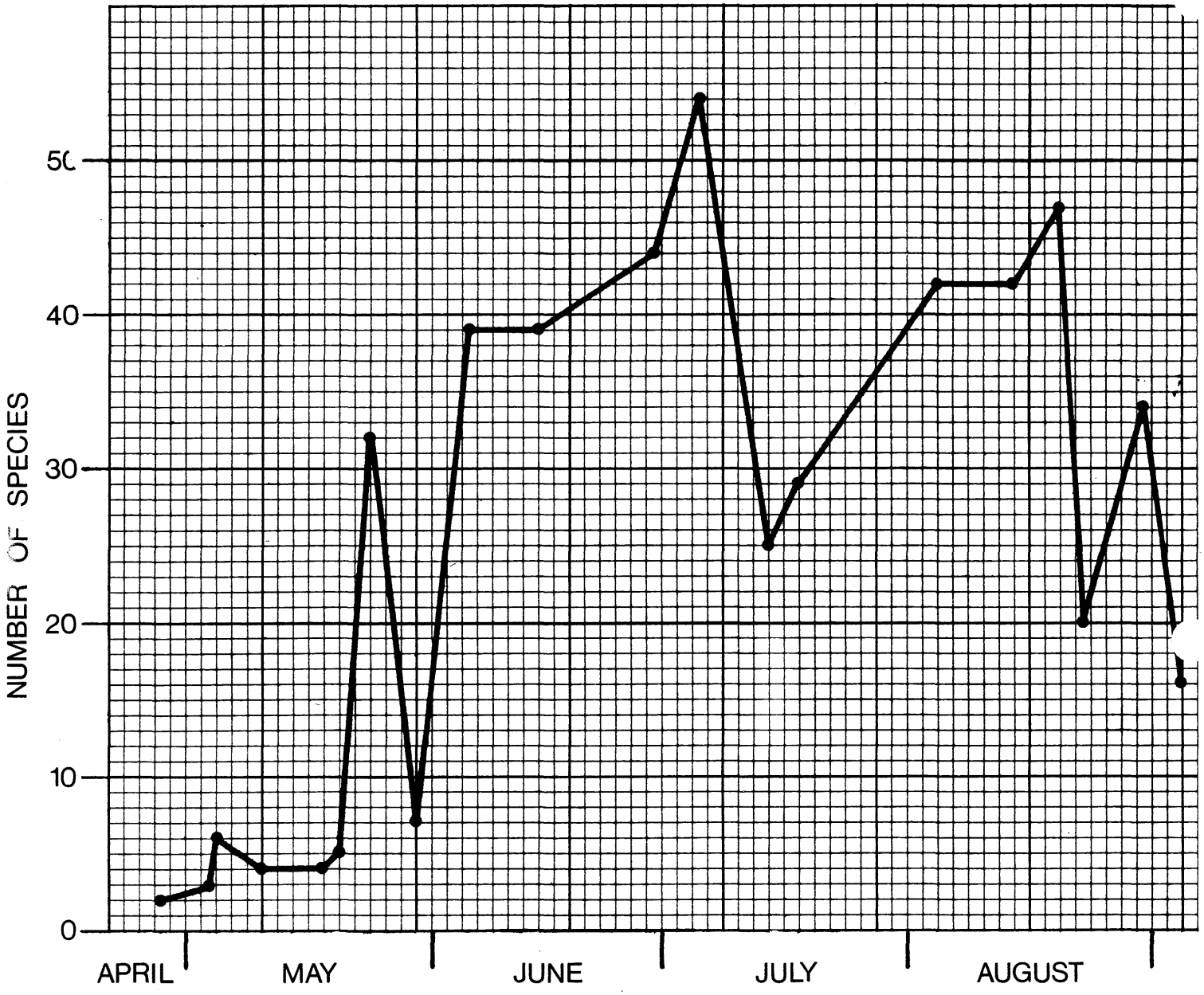

Figure 6. The 1979 blooming phenology on Boot Lake. Graph illustrates the number of plant species blooming on each visit to the preserve.

Table 3. Annotated List of Plants for Boot Lake Natural Area.

Format: Scientific name. Common name. Collection number of voucher specimen. Community in Boot Lake. Designated "alien" or "possible alien" if not native to Minnesota. Special significance of collection, if known. A (+) indicates a species was noted but not collected. Asterisk (*) if specimen was identified by John Moore. Species of the genus Carex were identified by Gerald Wheeler, all other specimens were verified by Dr. Gerald Owenby.

PTERIDOPHYTA - Spore-Bearing Plants

EQUISETACEAE - Horsetail Family
Equisetum fluviatile L. - Water Horsetail. #934. Lakeshore.

LYCOPODIACEAE - Clubmoss Family
Lycopodium clavatum L. - Running Clubmoss. #941. Old Road.
Lycopodium obscurum L. (L. dendroideum Michx. Britton and Brown, 1970) - Ground Pine. #940. Old Road.
Lycopodium tristachyum Pursh. - Ground Cedar. #1002. White Pine Red Maple Woods.

OPHIOGLOSSACEAE - Adder's-Tongue Family
Botrychium virginianum (L.) Sw. - Virginia Grape Fern. Wet Forest. +

OSMUNDACEAE - Royal Fern Family
Osmunda cinnamonea L. - Cinnamon Fern. #644. Wet Forest.
Osmunda claytoniana L. - Interrupted Fern. #616. Oak Forest.
Osmunda regalis L. - Royal Fern. #613. Edge of Forest.

POLYPODIACEAE - Polypody Family
Athyrium felix-femina Roth. - Lady Fern. #632. Edge of Wet Forest.
Dryopteris austriaca (Jacq.) Woynar, var. spinulosa (Muell.) Fiori. (D. spinulosa (O.F. Muell.) Watt. in Fernald, 1950) - Shield Fern. #631. Edge of Wet Forest.
Dryopteris cristata Gray. - Crested Wood Fern. #749. Edge of Wet Forest.
Gymnocarpium dryopteris (L.) Newm. - Oak Fern. #503. Wet Forest.
Onoclea sensiblis L. - Sensitive Fern. #937. Near Lakeshore.
Pteridium aquilinum (L.) Kuhn. - Bracken Fern. #887. Oak Forest.

SPERMATOPHYTA - Seed Plants

GYMNOSPERMAE - Gymnosperms

CUPRESSACEAE - Cypress Family
Juniperus communis L. var. depressa Pursh. - Prostrate Juniper. #1012. Oak Forest.
Juniperus virginiana L. - Red Cedar. #1062. Clearing.

PINACEAE - Pine Family
Larix laricina (DuRoi) K. Koch. - Tamarack. #496. Edge of Floating Mat.
Picea abies (L.) Karst. (in Fernald, 1950) - Norway Spruce. #897. Roadside. Alien.

Pinus banksiana Lamb. - Jack Pine. #1022. Edge of Oak Forest.
Pinus strobus L. - White Pine. #766. Edge of Wet Forest.
Pinus sylvestris L. - Scotch Pine. #943. Edge of Old Field.

ANGIOSPERMAE - Angiosperms

MONOCOTYLEDONEAE - Monocots

ALISMATACEAE - Water Plantain Family
Sagittaria latifolia Willd. - Hastate-Leaved Arrow-Head. #998. Wet Forest.

ARACEAE - Arum Family
Arisaema triphyllum (L.) Schott. - Jack In The Pulpit. #290. Oak Forest.
Calla palustris L. - Water Arum. #396. Wet Forest.

COMMELINACEAE - Spiderwort Family
Tradescantia occidentalis (Britt.) Smyth. - Western Spiderwort. #617. Roadside.

CYPERACEAE - Sedge Family
Carex brunnescens (Pers.) Poir. (C. brunnescens (Pers.) Poir. var. sphaerostachya (Tuckerm.) Kukenth. in Fernald, 1950). #606. Jack Pine Bog.
Carex canescens L. - Silvery Sedge. #292. Floating Mat.
Carex comosa Boott. - Bristly Sedge. #756. Edge of Lake.
Carex disperma Dewey. - Soft-Leaved Sedge. #375. Wet Forest.
Carex hystericina Muhl.- Porcupine Sedge. #609. Wet Forest.
Carex lacustris Willd. - #285. Edge of Wet Meadow.
Carex oligosperma Michx. - Few-Seeded Sedge. #408. Wet Forest.
Carex paupercula Michx. - Bog Sedge. #374. Wet Forest.
Carex pensylvanica Lam. - Pennsylvania Sedge. #235. Oak Forest.
Carex pseudo-cyperus L. - Cyperus-Like Sedge. #504. Wet Forest.
Carex scoparia Schk. - Pointed Broom Sedge. #628. Near Road.
Carex siccata Dewey. - (C. foenea Willd. in Fernald, 1950) - Dry-Spiked Sedge. #373. Old Road.
Carex stipata Muhl. - Saw-Beak Sedge. #412. Shrub Thicket.
Cyperus filiculmis Vahl. (C. filiculmis (Vahl. var. macilentus in Fernald, 1950) - Few-Flowered Slender Cyperus. #1128. Old Field. *
Cyperus strigosus L. - Straw-Colored Cyperus. #1132. Near Road. *
Dulichium arundinaceum (L.) Britt. - Three Way Sedge. #757. Lake Shore.
Eleocharis erythropoda Steud. (E. calva Torr. in Fernald, 1950). Marsh Spike Rush. #649. Edge of Old Road. *
Eleocharis palustris (L.) R. & S. (E. smallii in Fernald, 1950) - Small's Spike Rush. #928. Edge of Floating Mat. *
Eriophorum angustifolium Honckeny. - Tall Cottongrass. #261. Wet Forest. *
Eriophorum virginicum L. - Virginia Cottongrass. #750. Wet Forest. *
Scirpus americanus Pers. - Three-Square. #647. Edge of Wet Meadow. *
Scirpus atrovirens Willd. - Bulrush. #650. Edge of Shrub Thicket. *
Scirpus cyperinus (L.) Kunth. - Dark Bracted Wool Grass. #1004. Wet Forest.

IRIDACEAE - Iris Family
Iris versicolor L. - Blue Flag. #634. Swampy Area.

LEMNACEAE - Duckweed Family
Lemna minor L. - Lesser Duckweed. Shrub Thicket. +
Lemna trisulca L. - Ivy-Leaved Duckweed. #1085. Lake Shore.

LILIACEAE - Lily Family
Asparagus officinalis L. - Asparagus. #578. Oak Forest.
Clintonia borealis (Ait.) Raf. - Yellow Clintonia. #382. Oak Forest.
Maianthemum canadense Desf. - Wild Lily of the Valley. #386. Wet Forest.
Polygonatum biflorum (Walt.) Ell. - Solomon's Seal. #583. Oak Forest.
Smilacina racemosa (L.) Desf. - False Solomon's Seal. Oak Forest. +
Smilacina stellata (L.) Desf. - Star-Flowered False Solomon's Seal. #303. Prairie.
Trillium cernuum L. - Nodding Wake-Robin. #301. Wet Forest.
Uvularia sessilifolia L. - Pale Bellwort. #266. Oak Forest.

ORCHIDACEAE - Orchid Family
Cypripedium acaule Ait. - Stemless Lady-Slipper. #395. Wet Forest.

POACEAE - Grass Family
Agropyron repens (L.) Beauv. - Quack Grass. #619. Roadside. Alien.
Agrostis hyemalis (Walt.) BSP var. tenuis (Tuckerm) Gl. (A. scabra Willd. in Fernald, 1950) - Rough Bent Grass. #591. Edge of Old Field. *
Andropogon gerardi Vitm. - Big Bluestem. #905. Roadside.
Andropogon scoparius Michx. - Little Bluestem. #1061. Prairie-Like Area.
Bromus inermis Leyss. - Smooth Brome. #587. Edge of Agricultural Field and Oak. Alien. *
Calamagrostis canadensis (Michx.) Beauv. - Blue Joint. #571. Edge of Floating Mat.
Cenchrus longispinus (Hack.) Fern. - Sandbur. #898. Roadside, Possible Alien.
Echinochloa muricata (Beauv.) Fern. (E. pungens (Poir.) Rydb. in Fernald, 1950) - Bristley Barnyard Grass. #1072. Roadside. *
Eragrostis spectabilis (Pursh.) Steud. - Purple Love Grass. #1074. Old Field.
Glyceria canadensis (Michx.) Trin. - Rattlesnake Grass. #605. Moat Surrounding Jack Pine Bog. *
Glyceria striata (Lam.) Hitch. - Fowl Manna Grass. #400. Shrub Thicket.
Leersia oryzoides (L.) Sw. - Rice Cut Grass. #1070. Shrub Thicket. *
Muhlenbergia mexicana (L.) Trin. - Mexican Satin Grass. #920. Lakeshore. *
Panicum oligosanthes Schult. (P. oligosanthes Schutt. var. scribnerianum (Nash) Fern. in Fernald, 1950) - Scribner's Panic Grass. Edge of Field. *
Panicum villosissimum Nash var. pseudopubescens (Nash) Fern. - Appressed White-Haired Panic Grass. #633. Edge of Oak Forest. *
Phalaris arundinacea L. - Reed Canary Grass. #573. Lake Shore. Possible Alien.
Phleum pratense L. - Timothy Grass. #618. Roadside. Alien.
Poa palustris L. - Fowl Meadow Grass. #502. Old Field.
Poa pratensis L. - Kentucky Blue Grass. #279. Near Sandpit. Possible Alien.
Setaria glauca (L.) Beauv. - Foxtail Grass. #1129. Edge of Old Field.

Sorghastrum nutans (L.) Nash. - Indian Grass. #932. Prairie-Like Area.
Sporobolus cryptandrus (Torr.) Gray. Sand Dropseed. #933. Sand Pit.
Stipa spartea Trin. - Porcupine Grass. #620. Roadside.
Zizania aquatica L. - Wild Rice. #929. Lake Shore.

POTAMOGETONACEAE - Pondweed Family
Potamogeton zosteriformis Fern. - American Eel-Grass Pondweed. #927. In Lake.

TYPHACEAE - Cat-Tail Family
Typha latifolia L. - Broad-Leaved Cat-Tail. #743. Floating Mat.

DICOTYLEDONEAE - Dicots

ACERACEAE - Maple Family
Acer rubrum L. - Red Maple. #237. Wet Forest.

ANACHARDIACEAE - Cashew Family
Rhus radicans L. - Poison Ivy. Oak Forest.+
Rhus vernix L. - Poison-Sumac. #570. Floating Mat.
Rhus typina L. - Staghorn Sumac. #1015. Edge of Old Field.

APIACEAE - Parsley Family
Cicuta bulbifera L. - Bulb-Bearing Water Hemlock. #1069. Shrub Thicket.
Osmorhiza claytoni (Michx.) Clarke. - Sweet Cicely. #585. Oak Forest.

APOCYNACEAE - Dogbane Family
Apocynum androsaemifolium L. - Spreading Dogbane. Oak Forest. +

AQUIFOLIACEAE - Holly Family
Ilex verticillata (L.) Gray. - Black Alder. #372. Wet Forest.
Nemopanthus mucronatus (L.) Trel. - Mountain Holly. #295. Wet Forest.

ARALIACEAE - Ginseng Family
Aralia nudicaulis L. - Wild Sarsaparilla. #378. Edge of Oak Forest.
Aralia racemosa L. - Spikenard. Forest. +

ASCLEPIACLACEAE - Milkweed Family
Asclepias incarnata L. - Swamp Milkweed. #742. Floating Mat.
Asclepias syriaca L. - Common Milkweed. #748. Edge of Old Field and Oak Forest.
Asclepias tuberosa L. - Butterfly Weed. #638. Opening in Oak Forest.

ASTERACEAE - Composite Family
Achillea millefolium L. - Yarrow. #481. Edge of Prairie-Like Area.
Ambrosia artemisiifolia L. - Common Ragweed. #900. Roadside.
Antennaria neglecta Greene. - Pussy Toes. #265. Old Field.
Aster hesperius Gray. - White Aster. #916. Near Lake Shore. *
Aster junciformis Rydb. - Rush Aster. #921. Floating Mat.
Aster lateriflorus (L.) Britt. - Calico Aster. #923. Floating Mat.
Aster macrophyllus L. - Large-Leaved Aster. #1009. Oak Forest.
Aster puniceus L. - Red-Stalked Aster. #1080. Edge Shrub Thicket and Lake.

Aster umbellatus Mill. - Flat-Topped White Aster. #1082. Edge of Shrub Thicket and Lake.
Bidens coronata (L.) Britt. (B. coronata (L.) Britt. var tenniloba (Gray) Sherff. in Fernald, 1950) - Narrow-Lobed Showy Beggar-Ticks. #948. Shrub Thicket. *
Bidens frondosa L. - Leafy Beggar-Ticks. #995. Wet Forest. *
Cirsium discolor (Muhl.) Spreng. - Field Thistle. #1084. Edge of Shrub Thicket.
Cirsium vulgare (Savi) Tenore. - Bull Thistle. #1127. Oak Forest.
Conyza canadensis (L.) Croq. - Horseweed. #904. Roadside.
Crepis tectorum L. - Narrow-Leaved Hawk's-Beard. #589. Edge of Agricultural Field.
Erechtites hieracifolia (L.) Raf. - Fireweed. #994. Wet Forest.
Erigeron annuus (L.) Pers. - Daisy Fleabane. #593. Edge of Old Field.
Eupatorium maculatum L. - Joe Pye Weed. #1063. Edge of Shrub Thicket.
Eupatorium perfoliatum L. - Boneset. +
Gnaphalium obtusifolium L. - Sweet Everlasting. #931. Prairie-Like Area.
Helianthus hirsutus Raf. - Stiff-Haired Sunflower. #895. Roadside. *
Helianthus laetiflorus Pers. - Stiff-Leaved Sunflower. #891. Roadside.
Helianthus petiolaris Nutt. - Prairie Sunflower. #594. Roadside. Possible Alien.
Hieracium aurantiacum L. - King-Devil. Alien. +
Hieracium canadense Michx. - Hawkweed. #909. Roadside.
Hieracium longipilum Torr. - Long Bearded Hawkweed. #949. Prairie-Like Area. Potential Heritage Element.
Krigia biflora (Walt.) Blake. - Dwarf Dandelion. #626. Roadside.
Rudbeckia hirta L. - Black-Eyed Susan. #595. Roadside. Alien.
Senecio pauperculus Michx. - Dwarf Ragwort. #478. Edge of Wet Meadow.
Solidago gigantea Ait. - Late Goldenrod. #1135. Roadside. *
Solidago graminifolia (L.) Salisb. - Bushy Goldenrod. #1014. Old Road.
Solidago nemoralis Ait. - Gray Goldenrod. #1071. Edge of Prairie-Like Area.
Solidago speciosa Nutt.- Showy Goldenrod. #896. Roadside. *
Taraxacum officinale Weber. - Common Dandelion. #392. Old Road. Alien.
Tragopogon dubius Scop. - Goat's Beard. #405. Prairie-Like Area. Alien.

BALSAMINACEAE - Touch-Me-Not Family
Impatiens biflora Walt. - Spotted Touch-Me-Not. #894. Near Lake.

BETULACEAE - Birch Family
Alnus rugosa (DuRoi) Spreng. - Glaucous-Leaved Speckled Alder. #1117. Shrub Thicket.
Betula papyrifera Marsh. - Paper Birch. #286. Edge of Wet Meadow.
Betula pumila L. Bog Birch. #269. Wet Forest.
Corylus americana Walt. - American Hazelnut. #1021. Oak Forest.

BORAGINACEAE - Borage Family
Lithospermum canescens (Michx.) Lehm. - Hoary Puccoon. #418. Edge of Oak Forest.
Lithospermum caroliniense (Walt.) MacMill. - Carolina Puccoon. #588. Oak Forest.

BRASSICACEAE - Mustard Family
Arabis lyrata L. - Lyre-Leaved Rock Cress. #272. Roadside.
Berteroa incana (L.) D.C. - Hoary Allysum. #485. Edge of Wet Meadow.
Lepidium densiflorum Schrader. - Pepper-Grass. #394. Old Field.

CAMPANULACEAE - Harebell Family
Campanula aparinoides Pursh. - Marsh Bellflower. Floating Mat. +
Campanula rotundifolia L. - Harebell. #577. Oak Forest.

CAPRIFOLIACEAE - Honeysuckle Family
Diervilla lonicera Mill. - Bush Honeysuckle. #584. Oak Forest.
Lonicera dioica L. Wild Honeysuckle. Wet Forest. +
Lonicera villosa (Michx.) R. & S. - Fly Honeysuckle. #377. Wet Forest.
Sambucus pubens Michx. - Red-Berried Elder. #271. Oak Forest.
Viburnum opulus L. - High-Bush Cranberrry. +

CARYOPHYLLACEAE - Pink Family
Arenaria lateriflora L. Blunt-Leaved Sandwort. #388. Oak Forest.
Lychnis alba Mill - White Campion. #380. Old Field. Alien.
Silene antirrhina L. - Sleepy Catchfly. #492A. Old Field. Alien.
Stellaria longifolia Muhl. - Long-Leaved Stitchwort. #410. Shrub Thicket. *

CERATOPHYLLACEAE - Hornwort Family
Ceratophyllum demersum L. - Coontail. #926. In Lake.

CHENOPODIACEAE - Goosefoot Family
Chenopodium leptophyllum Nutt. - Narrow-Leaved Goosefoot. #901. Roadside.
Salsola kali L. - Russian Thistle. #899. Roadside. Alien.

CISTACEAE - Rockrose Family
Helianthemum bicknellii Fern. - Hoary Frostweed. #637. Edge of Old Field. *
Lechea intermedia Leggett. - Intermediate Pinweed. #902. Roadside. *

CONVOLVULACEAE - Morning Glory Family
Cuscuta umbrosa Hook. - Dodder. #991. Oak Forest. *

CORNACEAE - Dogwood Family
Cornus alternifolia L.f. - Pagoda Dogwood. #491. Edge of Oak Woods.
Cornus canadensis L. - Bunchberry. #393. Wet Forest.
Cornus racemosa Lam. - Gray Dogwood. #608. Forest.
Cornus stolonifera Michx. - Red Osier Dogwood. #488. Edge of Wet Meadow.

CUCURBITACEAE - Gourd Family
Echinocystis lobata (Michx.) T. & G. - Wild Cucumber. #893. Roadside.

ERICACEAE - Heath Family
Andromeda glaucophylla Link. - Bog Rosemary. #299. Sphagnum-Heath Bog.
Chamaedaphne calyculata (L.) Moench. - Leather-Leaf. #259. Sphagnum-Heath Bog.
Chimaphila umbellata (L.) Bart.- Prince's Pine. #942. Edge of Forest.

Gaultheria procumbens L. - Checkerberry. #950. Forest.
Gaylussacia baccata (Wang.) K. Koch. - Huckleberry. #889. Oak Forest.
Ledum groenlandicum Oeder. - Labrador-Tea. #391. Wet Forest.
Monotropa uniflora L. - Indian Pipe. #765. Wet Forest.
Pyrola elliptica Nutt. - Common Pyrola. #636. Near Lake.
Pyrola secunda L. - One-Sided Pyrola. #614. Edge of Wet Forest.
Vaccinium angustifolium Ait. - Narrow-Leaved Blueberry. #296. Oak Forest.
Vaccinium myrtilloides Michx. - Velvet Leaf Blueberry. #399. Wet Forest.
Vaccinium oxycoccos L. - Small Cranberry. #1168. Jack Pine Bog.

EUPHORBIACEAE - Spurge Family
Euphorbia glyptosperma Engelm. - Ridge-Seeded Spurge. #907. Roadside. *

FABACEAE - Bean Family
Amorpha canescens Pursh. - Lead Plant. #924. Oak Forest.
Amphicarpa bracteata (L.) Fern. - Hog Peanut. #992. Oak Forest.
Apios americana Medic. - Wild Bean. #1083. Edge of Shrub Thicket.
Desmodium canadense (L.) DC. - Canada Tick-Trefoil. #1130. Near Roadside.
Desmodium glutinosum (Muhl.) Wood. - Pointed-Leaved Tick-Trefoil. #751. Oak Forest.
Lathyrus ochroleucus Hook. - Pale Vetchling. #381. Oak Forest.
Lathyrus venosus Muhl var. intonsus Butters and St. John.- Veiny Pea. #635. Near Lake. *
Lespedeza capitata Michx. - Bush-Clover. +
Medicago lupulina L. - Black Medick. #652. Shrub Swamp. Alien.
Medicago sativa L. - Alfalfa. #586. Agricultural Field. Alien.
Melilotus alba Desr. - White Sweet Clover. Alien. +
Melilotus officinalis (L.) Desr. - Yellow Sweet Clover. Alien. +
Robinia pseudoacacia L. - Common Locust. #908. Roadside.
Trifolium arvense L. - Rabbit Foot Clover. #625. Sand Pit. Alien.
Trifolium hybridum L. - Alsike Clover. #629. Roadside. Alien.
Trifolium pratense L. - Red Clover. #486. Edge of Wet Meadow. Alien.
Trifolium repens L. - White Clover. #487. Edge of Wet Meadow. Alien.
Vicia villosa Roth. - Hairy Vetch. #490. Edge of Wet Meadow.

FAGACEAE - Beech Family
Quercus alba L. - White Oak. #1013. Oak Forest.
Quercus ellipsoidalis E.J. Hill. - Northern Pin Oak. #276. Edge of Oak Forest.

GENTIANACEAE - Gentian Family
Gentiana andrewsii Griseb. - Closed Gentian. #1081. Edge of Shrub Thicket.
Menyanthes trifoliata L. Buckbean. #293. Floating Mat.

GERANIACEAE - Geranium Family
Geranium maculatum L. - Wild Geranium. #383. Edge of Old Field.

HYPERICACEAE - St. John's-Wort Family
Hypericum majus (Gray) Britt. - Small-Flowered St. John's-Wort. #990. Edge of Old Field.

Triadenum virginicum (L.) Raf. (Hypericum v. L. in Fernald, 1950) - Marsh St. John's-Wort. #990. Edge of Old Field.

JUGLANDACEAE - Walnut Family
Juglans cinerea L. - Butternut. #291. Edge of Oak Forest.

JUNCACEAE - Rush Family
Juncus nodosus L. - Knotted Rush. #648. Edge of Shrub Thicket. *
Juncus pelocarpus E. Meyer. - Brown Fruited Rush. #630. Roadside.
Juncus tenuis Willd. - Slender Rush. #592. Old Road. *

LAMIACEAE - Mint Family
Agastache foeniculum (Pursh) Kuntze. - Fragrant Giant Hyssop. #910. Roadside.
Lycopus americanus Muhl.- Water Horehound. #1126. Old Road.
Lycopus uniflorus Michx. - Northern Bugleweed. #938. Old Road.
Mentha arvensis L. - Wild Mint. #917. Near Lake Shore.
Monarda fistulosa L. - Wild Bergamot. #886. Oak Forest.
Prunella vulgaris L. - Self-Heal. #1131. Near Roadside.
Pycnanthemum virginianum (L.) Durand & Jackson. - Mountain Mint. #1131A. Near Roadside.
Scutellaria galericulata L. - Marsh Skullcap. #642. Wet Forest.
Stachys palustris L. - Woundwort. #654. Edge of Old Road.

LENTIBULARIACEAE - Bladderwort Family
Utricularia vulgaris L. - Greater Bladderwort. #1077. Lake Shore.

LOBELIACEAE - Lobelia Family
Lobelia inflata L. - Indian Tobacco. #988. Edge of Old Field.
Lobelia siphilitica L. - Louisiana Lobelia. #922. Lakeshore.

LYTHRACEAE - Loosestrife Family
Decodon verticillatus (L.) Ell. - Water-Willow. #915. Edge Lakeshore and Floating Mat.

NYMPHAEACEAE - Water Lily Family
Nymphaea tuberosa Paine. - Sweet-Scented White Water Lily. #925. In Lake.
Nuphar variegatum Engelm. - Bullhead Water Lily. #1118. Creek.

OLEACEAE - Olive Family
Fraxinus pennsylvanica Marsh. - Green Ash. #401. Shrub Thicket.

ONAGRACEAE - Evening-Primrose Family
Circaea alpina L. - Enchanter's Nightshade. #582. Wet Forest.
Circaea quadrisulcata (Maxim.) Franch. & Sav. - Enchanter's Nightshade. #641. Oak Forest.
Epilobium glandulosum Lehm. - Northern Willow-Herb. #760. Wet Forest.
Epilobium strictum Muhl. - Downy-Willow Herb. #912. Floating Mat.
Oenothera parviflora L. - Northern Evening-Primrose. #1073. Edge of Old Field.

OXALIDACEAE - Wood-Sorrel Family
Oxalis stricta L. - Upright Wood-Sorrel. #379. Old Field. Possible Alien.

PHRYMACEAE - Lopseed Family
Phryma leptostachya L. - Lopseed. #752. Oak Forest.

PLANTAGINACEAE - Plantain Family
Plantago rugelii Decne. - Rugel's Plantain. #762. Old Road.

POLEMONIACEAE - Phlox Family
Phlox pilosa L. - Shining Prairie Phlox. #627. Roadside.

POLYGALACEAE - Milkwort Family
Polygala polygama Walt. - Racemose Milkwort. #1134. Roadside.

POLYGONACEAE - Smartweed Family
Polygonum coccineum Muhl. - Swamp Smartweed. Shrub Thicket. +
Polygonum covolvulus L. - Black Bindweed. #767. Old Field. Alien.
Polygonum lapathifolium L. - Dock-Leaved Smartweed. #624. Edge of Prairie-Like Area. *
Polygonum aviculare L. - Knot-Grass. #906. Roadside. *
Polygonum pensylvanicum L. - Pennsylvania Smartweed. #1019. Old Field.
Polygonum punctatum Ell. - Dotted Smartweed. #911. Floating Mat. *
Polygonum sagittatum L. - Arrow-Leaved Tear-Thumb. #1120. Floating Mat.
Rumex acetosella L. - Field Sorrel. #273. Old Field.
Rumex orbiculatus Gray. - Great Water Dock. #913. Floating Mat.

PRIMULACEAE - Primrose Family
Lysimachia thyrsiflora L. - Tufted Loosestrife. #413. Shrub Thicket.
Trientalis borealis Raf. - Northern Star Flower. #304. Wet Forest.

RANUNCULACEAE - Crowfoot Family
Actaea rubra (Ait.) Willd. - Red Baneberry. #745. Oak Forest.
Anemone cylindrica Gray. - Thimbleweed. #640. Opening in Oak Woods.
Anemone quinquefolia L. - Wood anemone. #264. Oak Forest.
Aquilegia canadensis L. - Wild Columbine. #384. Oak Forest.
Caltha palustris L. - Marsh Marigold. #268. Wet Forest.
Delphinium virescens Nutt. - Prairie Larkspur. #639. Oak Forest.
Ranunculus abortivus L. - Small-Flowered Crowfoot. #390. Old Road.
Ranunculus pensylvanicus L.f. - Bristly Buttercup. #761. Wet Forest.
Ranunculus recurvatus Poir. - Hooked Buttercup. #576. Oak Forest.
Thalictrum dasycarpum Fisch & Ave-Lall. - Tall Meadow Rue. #651. Edge of Shrub Thicket.

RHAMNACEAE - Buckthorn Family
Coptis trifolia (L.) Salisb. (C. groenlandica (Oeder) Fern. in Fernald, 1950) - Goldthread. #267. Wet Forest.
Rhamnus frangula L. - Alder Buckthorn. #996. Wet Forest.

ROSACEAE - Rose Family
Amelanchier laevis Wieg. - Smooth Juneberry. #270. Edge of Oak Forest.
Aronia melanocarpa (Michx.) Ell. - Black Chokeberry. #397. Wet Forest.
Fragaria vesca L. - Wood Strawberry. #1011. Oak Forest.
Fragaria virginiana Duchesne. - Wild Strawberry. #258. Edge of Old Field.
Geum aleppicum Jacq. - Yellow Avens. #575. Oak Forest.
Potentilla arguta Pursh. - Tall Cinquefoil. #930. Prairie-Like Area.
Potentilla norvegica L. - Rough Cinquefoil. #746. Old Field.
Potentilla palustris (L.) Scop. - Marsh Cinquefoil #569. Floating Mat.
Potentilla recta L. - Sulfur Cinquefoil. #596. Roadside.
Potentilla simplex Michx. - Old Field Cinquefoil. #489. Edge of Wet Meadow.
Prunus pensylvanica L.f. - Pin Cherry. #759. Edge of Old Field.
Prunus serotina Ehrh. - Black Cherry. #499. Oak Forest.
Prunus triloba Lindel. (in Morley, 1966) - Flowering Almond. #298. Oak Forest. *
Prunus virginiana L. - Choke Cherry. #302. Oak Forest.
Rosa suffulta Greene. - Wild Prairie Rose. #655. Edge of Agricultural Field.
Rubus allegheniensis Porter. - Common Blackberry. #1024. Edge of Old Field.
Rubus flagellaris L. - Northern Dewberry. #500. Edge of Oak Forest. *
Rubus pubescens Raf. - Dwarf Blackberry. #389. Wet Forest.
Rubus strigosus Michx. - Red Raspberry. #1114. Wet Forest.
Spiraea alba DuRoi - Meadow Sweet. #946. Shrub Thicket.
Spiraea tomentosa L. - Steeplebush. #409. Wet Forest.

RUBIACEAE - Madder Family
Galium boreale L. - Northern Bedstraw. #579. Edge of Oak Forest.
Galium labradoricum (Wieg.) Wieg. - Labrador Marsh Bedstraw. #612. Wet Forest. *
Galium obtusum Bigel. - Clayton's Bedstraw. #568. Wet Forest.
Galium trifidum L. - Small Bedstraw. #1001. Wet Forest. *
Galium triflorum Michx. - Sweet-Scented Bedstraw. #566. Oak Forest.
Mitchella repens L. - Partridge Berry. #656. Edge of Wet Forest.

RUTACEAE - Rue Family
Zanthoxylum americanum Mill. - Prickly Ash. #297. Edge of Oak Forest.

SALICACEAE - Willow Family
Populus grandidentata Michx. - Bigtooth Aspen. #890. Oak Forest.
Populus tremuloides Michx. - Quaking Aspen. #1075. Edge of Old Field and Wet Area.
Salix bebbiana Sarg. - Beaked Willow. #280A. Edge of Wet Meadow.
Salix discolor Muhl. - Pussy-Willow. #238. Shrub Thicket.
Salix petiolaris Sm. - Slender Willow. #239. Shrub Thicket.
Salix pedicellaris Pursh. - Bog-Willow. #498. Floating Mat.
Salix pyrifolia Anderss. - Balsam Willow. #1167. Moat around Jack Pine Bog.
Salix serissima (Bailey) Fern. - Autumn-Willow. #402. Shrub Thicket.

SAXIFRAGACEAE - Saxifrage Family
Parnassia palustris L. - Grass of Parnassus. #1079. Edge of Shrub Thicket.
Ribes americanum Mill. - Wild Black Currant. #281. Edge of Wet Meadow.
Ribes cynosbati L. - Dogberry. #288. Oak Forest.
Ribes hirtellum Michx. - Swamp Gooseberry. #411. Shrub Thicket.
Saxifraga pensylvanica L. - Swamp Saxifrage. #493. Edge of Wet Meadow.

SCROPHULARIACEAE - Figwort Family
Castilleja coccinea (L.) Spreng. - Painted Cup. #482. Edge of Prairie-Like Area.
Gerardia tenuifolia Vahl. - Slender-Leaved Gerardia. #944. Roadside.
Lindernia dubia (L.) Pennell. - False Pimpernel. #753. Lake Shore.
Pedicularis lanceolata Michx. - Swamp Lousewort. #1060. Edge of Wet Meadow.
Verbascum thapsus L. - Great Mullein. #747. Old Field. Alien.

SOLANACEAE - Night Shade Family
Physalis heterophylla Nees. - Clammy Ground Cherry. #1020. Edge of Old Field.

TILIACEAE - Linden Family
Tilia americana L. - Basswood. #918. Near Lakeshore.

ULMACEAE - Elm Family
Ulmus americana L. - American Elm. #610. Forest.

URTICACEAE - Nettle Family
Boehmeria cylindrica (L.) Sw. False Nettle. +
Pilea fontana (Lunell) Rydb. - Black-Fruited Clearweed. Floating Mat. +
Urtica dioica L. - Stinging Nettle. +

VERBENACEAE - Verbena Family
Verbena hastata L. - Blue Vervain. #744. Old Field.

VIOLACEAE - Violet Family
Viola conspersa Reichenb. - American Dog Violet. #263. Oak Forest.
Viola pallens (Banks) Brainerd. - Wild White Violet. #262. Oak Forest.
Viola pedatifida G. Don. - Prairie Violet. #277. Prairie-Like Area.
Viola sagittata Ait. - Arrow-Leaved Violet. #480. Edge of Wet Meadow.
Viola sororia Willd. - Common Blue Violet. #257. Edge of Old Field.

VITACEAE - Grape Family
Parthenocissus vitacea (Knerr) Hitchc. (P. inserta (Kerner) Fritsch., misapplied) - Virginia Creeper. #1008. Oak Forest.
Vitis riparia Michx. - Riverbank Grape. #1010. Oak Forest.

The following additional plant species were identified in releve plots. Voucher specimens were not collected.

FAGACEAE
Quercus cf. borealis

POACEAE
Glyceria striata var. stricta

POLYPODIACEAE
Thelypteris palustris

ROSACEAE
Rubus occidentalis

VERBENACEAE
Verbena stricta

Results

Table 3 is an annotated list of the plants identified on the tract.[1] A total of 319 vascular plant species[2], representing 77 families, were recorded on the unit in 1979. Twenty-seven of these species are alien. The families with the largest number of species were: Asteraceae with 35 species (10.97% of total), Poaceae with 24 species (7.52% of total). and Cyperaceae with 23 species (7.21% of total).

Figure 6 illustrates the number of species in flower on each visit to the preserve. A total of 234 species were included. The peak of blooming occurred in early July.

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1 Nomenclature is according to Gleason and Cronquist (1963).
2 This total does not include additional plant species identified in releve plots.

ZOOLOGICAL COMPONENTS

Animals are found on virtually all of Minnesota's natural areas. Their diversity is determined by both abiotic and vegetational components of the environment. Reciprocally, the zoological components may have a limited effect on the vegetational and abiotic resources of an area; seed dispersal, soil aeration, and water levels, for example, are often influenced by animals. In addition, certain animals species, by their presence or absence, are considered ecological indicators that provide information on changes occurring in the area. An inventory of birds, mammals, amphibians, and reptiles was conducted to: 1) document the area's species diversity, 2) obtain baseline data so changes can be discerned, and 3) identify rare, sensitive, or representative species and communities.

BIRDS

Methods

The 1979 bird inventory used a variation of the IPA (Indices Ponctuels d'Abondance) or Point Count Method (Robbins, 1978) to inventory breeding birds. This method infers a breeding territory based on repetition of a singing male in the same area during the breeding season (May-June). Fourteen circular stations (50 m radius) were established to include each of the major habitat types. A researcher visited the tract once a week, remaining 10 minutes at each station. The time of day and order in which the stations were visited was varied. All birds seen or heard from each station were recorded. A minimum of three non contemporaneous occurrences of a particular species on a given station was used as a guideline for inferred breeding of that species. Additional species observed outside of the established stations were also recorded.

Species identification was based on visual observations, songs, and/or nest characteristics. Locating nests was done on an incidental basis throughout the field season.

Results

The results of the 1979 bird inventory are presented in the form of an annotated list, Table 4. Seventy-two species of birds, representing 26 families, were observed on or above Boot Lake natural area. Four species were found nesting on the area with 13 others recorded as inferred breeders. Great Blue Herons were seen regularly on the area, possibly using Boot Lake as a feeding ground.[1]

1 Additional information, in the form of field data sheets and secondary sources, is on file, Scientific and Natural Areas Section, St. Paul.

Key to Table 4

FAMILY/SCIENTIFIC NAME: Names are in phylogenetic order, according to Green and Janssen, 1975.

DATE: Date of first observation.

HABITAT: All habitats where a given species was observed are listed.

OWo - Oak Woods
Pr - Prairie
FlM - Floating Mat
TBB - Tamarack Birch Bog
EgL - Edge of Lake
WM - Wet Meadow
PBWo - Pine-Birch Woods
EgF - Edge of Field
CB - Conifer Bog
TWF - Tamarack Wet Forest
MBWo - Maple-Birch Woods
PBWo - Pine-Birch Woods
Mh - Marsh
ToP - Throughout Preserve

RESIDENCY: Represents a basic breakdown based on breeding populations in Minnesota (Green and Janssen, 1975).

P - Permanent Resident
S - Summer Resident
W - Winter Visitant

BREEDING STATUS:

● - Positive Nesting - nest with eggs, adult sitting on nest constantly, or eggshells near nest; young in nest; downy young or young still unable to fly seen away from nest (Green and Janssen, 1975).

O - Inferred Nesting - adults seen building nest, in distraction display, carrying fecal sac, or carrying food; fledglings seen in area (Green and Janssen, 1975).

⊕ - Inferred Breeding - based on the Point Count Method (Robbins, 1978), a minimum of two noncontemporaneous occurrences of a species at a given observation station.

TABLE 4. ANNOTATED LIST OF BIRDS OBSERVED AT BOOT LAKE

FAMILY/SCIENTIFIC NAME	COMMON NAME	DATE	HABITAT	RESI-DENCY	BREEDING STATUS	REMARKS
GAVIIDAE						
Gavia immer	Common Loon	20 May	L	S		
ARDEIDA						
Ardea herodis	Great Blue Heron	26 April	Pr F/M Tbb OWo	S		
ARDEIDAE						
Butorides virescens	Green Heron	5 June	F/M	S		
ANATIADAE						
Branta canadensis	Canada Goose	20 May	EgL	S		
Anas platyrhynchos	Mallard	17 May	EgL WM	S	●	1 nest 11 eggs 5/17/79
Anas discors	Blue-Winged Teal	20 May	EgL	S	●	1 nest 11 eggs 5/20/79
Aix sponsa	Wood Duck	20 May	F/M OWo	S		
ACCIDITRIDAE						
Buteo jamaicensis	Red-Tailed Hawk	10 May	F/M OWo	S		
Buteo platypterus	Broad-Winged Hawk	5 July		S		Observed Flying
Circus cyaneus	Marsh Hawk	26 April	F/M EgF	S		
TETRAONIDAE						
Banasa umbellus	Ruffed Grouse	26 April	OWo	P	●	Parent with young 6/29/79
PHASINAIDAE						
Phasianus colchirus	Ring-Necked Pheasant	10 May	Pr OWo	P		
RALIIDAE						
Porzona carolina	Sora	10 May	Pr	S		
SCOLOPACIDAE						
Actitis macularia	Spotted Sandpiper	10 May	EgF	S	●	1 nest 3 eggs 5/10/79
COLUMBIDAE						
Zenaida macroura	Mourning Dove	29 May	F/M OWo	S		
COCULIDAE						
Coccyzus erythropthalmus	Black-Billed Cuckoo	5 July	EgF	S		

TABLE 4 (Continued) ANNOTATED LIST OF BIRDS OBSERVED AT BOOT LAKE

FAMILY/SCIENTIFIC NAME	COMMON NAME	DATE	HABITAT	RESI-DENCY	BREEDING STATUS	REMARKS
STRIGIDAE						
Strix varia	Barred Owl	26 April	EgF	P		
PICIDAE						
Colaptes auratus	Common Flicker	4 May	EgF OWo CB TWF	S		
Dendrocopus villosus	Hariy Woodpecker	26 April	MBW OWo BBWo	P		
Dendrocopus pubsescens	Downy Woodpecker	10 May	EgF OWo	P		
TYRANNIDAE						
Myiarchus crinitus	Great Crested Flycatcher	17 May	WM FLM	S	⊖	
Sayornis phoebe	Eastern Phoebe	4 May	CB WM	S	⊖	
Contopus virens	Eastern Wood Pewee	17 May	EgF OWo	S	⊖	
HIRUNDINIDAE						
Iridoprocne bicolor	Tree Swallow	3 May	OWw	S		
Hirundo rustica	Barn Swallow	5 June	EgF	S		
CORVIDAE						
Cyanocitta cristata	Blue Jay	4 May	EgF Pr	P	⊖	
Corvus brachyrynchus	Common Crow	26 April	EgF OWo PBWo	P	⊖	
PARIDAE						
Parus atricapillus	Black-Capped Chickadee	26 April	MBW OWo EgG	P	⊖	
SITTIDAE						
Sitta carolinensis	White-Breasted Nuthatch	26 April	CB OWo	P	⊖	
MIMIDAE						
Dumetella carolinensis	Gray Catbird	10 May	WM PBWo TBW Pr	S		

TABLE 4. (Continued) ANNOTATED LIST OF BIRDS OBSERVED AT BOOT LAKE

FAMILY/SCIENTIFIC NAME	COMMON NAME	DATE	HABITAT	RESI-DANCY	BREEDING STATUS	REMARKS
TURDIDAE						
Turdus migratorius	American Robin	4 May	OWo MB F/M	S	⊖	
Catharus guttatus	Hermit Thrush	17 May	OWo	S		
Catharus fuscescens	Veery	20 May	F/M TWF	S	⊖	
SYLVIIDAE						
Regulus calendula	Ruby-Crowned Kinglet	29 May	Mh	S		
STURNIDAE						
Sturnus vulgaris	Starling	3 May	TBB	P		
VIREONIDAE						
Vireo flavifrons	Yellow-Throated Vireo	20 May	OWo	S		
Vireo olivaceus	Red-Eyed Vireo	10 May	OWo WM Pr	S	⊖	
PARULIDAE						
Mniotilta varia	Black-And-White Warbler	10 May	EgF	S		
Vermivora chrysoptera	Golden-Winged Warbler	29 May	TBB F/M WM	S		
Vermivara peregrina	Tennessee Warbler	10 May	OWo BBWo	S		
Vermivora ruficapilla	Nashville Warbler	10 May	OWo PBWo	S		
Dendroica petechia	Yellow Warbler	26 April	MBW	S		
Dndroica magnolia	Magnolia Warbler	10 May	OWo	S		
Dendroica tigrina	Cap May Warbler	10 May	PBWo	S		
Dendroica coronata	Yellow-Rumped Warbler	3 May	OWo CB EgF	S		
Dendroica virens	Black-Throated Green Warbler	10 May	PBWo	S		
Dendroica fusca	Blackburnian Warbler	10 May	OWo PBWo	S		
Dendroica pensylvanica	Chestnut-Sided Warbler	10 May	EgF OWo	S		
Dendroica striata	Blackpoll Warbler	20 May	PBWo	M		
Dendroica pinus	Pine Warbler	10 May	PBWo	S		
Dendroica palmarum	Palm Warbler	10 May	CB	S		

TABLE 4. (Continued) ANNOTATED LIST OF BIRDS OBSERVED AT BOOT LAKE

FAMILY/SCIENTIFIC NAME	COMMON NAME	DATE	HABITAT	RESI-DENCY	BREEDING STATUS	REMARKS
PARULIDAE						
Seiurus aurocapillus	Ovenbird	10 May	OWo	S		
Geothlypis trichas	Common Yellowthroat	10 May	CB EgF PBWo F/B TBB	S		
Setophaga niticilla	American Redstart	10 May	F/M OWo	S		
ICENDAE						
Xanthocephalus xanthocephalus	Yellow-Headed Blackbird	5 June	F/M	S		
Agelaius phoeniceus	Red-Winged Blackbird	4 May	EgF Pr F/M MBW	S	⊕	
Icterus galbula	Northern Oriole		PBWo OWO	S		
Euphagus cyanocephalus	Brewer's Blackbird	4 May	TWF	S		
Quiscalus quiscula	Common Grackle	5 June	EgF	S		
Molothrus ater	Brown-Leaded Cowbird	4 May	TOP	S		
THRAUPIDAE						
Piranga olivaces	Scarlet Tanager	20 May	W/B OWo CB	S		
FRINGILLIADE						
Cardinalis cardinalis	Cardinal	10 May	TWF	P		
Pheusticus ludovicianus	Rose-Breasted Grosbeak	10 May				
Passerina cyanea	Indigo Bunting	20 May	OWO	S		
Carpodacus purpureus	Purple Finch	20 May	OWO	S		
Spinus tristis	American Goldfinch	29 June	EgF	S		
Ammodramus savannarum	Grasshopper Sparrow	14 June	WM	S		
Pooecetes gramineus	Vesper Sparrow	26 April	OBWo EgF	S		
Spizella passerina	Chipping Sparrow	26 April	TWF CB OWo	S		
Zonotrichia albicollis	White-Throated Sparrow	10 May	OWO CB	S		
Melospiza guorginan	Swamp Sparrow	3 May	WM MBW PBWo F/M OWo	S	⊕	
Melospiza melodia	Song Sparrow	3 May	TBB EgF	S	⊕	

Sources of Information

Harrison, Hal H. 1975. A Field Guide to Birds' Nests, Peterson Field Guide Series #21. Houghton Mifflin Company, Boston.

Pettingill, Olin Sewall Jr. 1970. Ornithology in Laboratory and Field. Burgess Publishing Company, Minneapolis.

Robbins, Chandler S., B. Bruun, H.S. Zim. 1966. Birds of North America. Golden Press, New York.

Robbins, Chandler S. 1978. Census Techniques For Forest Birds. Proceedings of the Workshop Management of Southern Forests for Non-game Birds. U.S. Department Agriculture Forest Service General Technical Report SE-14:142-163.

Additional Sources of Information

Peterson Field Guide. A Field Guide to Bird Songs. Eastern and Central. 1971. Houghton Mifflin Company, Boston.

Sounds of Nature Series. Vol. IV Warblers, Vol. VI Finches, Federation of Ontario Naturalists.

MAMMALS

Methods

Mammals were identified by sight, track, sound, and collections. Collection tools used were drift fences, live and snap traps. The 1979 mammal inventory was conducted late in the summer; incidental observations were made throughout the summer.

The mammal inventory was conducted over a three day period during which traps were set and scent stations were made. A trapline was set in each of the major habitat types. Each line consisted of 16 Museum Special snap traps, two Shermans, one Havahart and one wooden live trap set approximately 8 m. apart. Traps were baited with a peanut butter and oatmeal mixture. Victor Pocket Gopher traps were set in gopher mounds. The drift fences used during the amphibian and reptile inventory were re-opened. Scent stations, 1 m diameter, were established on mounds of soil excavated by pocket gophers. Artificial scent was placed in the center of these stations.

Traps and scent stations were checked once daily over a three day trapping period. The specimens were collected for measurements and identification, live duplicates were released. A male and a female of each species collected were deposited in the Bell Museum of Natural History, University of Minnesota, Department of Ecology and Behavior Biology, as voucher specimens.

Table 5. Mammals Identified on Boot Lake Natural Area.

Family Name/ Scientific Name	Common Name	Habitat
SORICIDAE		
Sorex cinereus	Masked Shrew	Pines, Pine Tamarack, Wet Forest, Jack Pine Bog, Maple-Birch Wet Forest
Blarina brevicauda	Short-tailed Shrew	Pine, Jack Pine Bog, Tamarack, Wet Forest
SCIURIDAE		
Tamiasciurus hudsonicus	Red Squirrel	
Tamias striatus	Eastern Chipmunk	
Sciurus carolinensis	Eastern Gray Squirrel	
GEOMYIDAE		
Geomys bursarius	Plains Pocket Gopher	
CRICETIDAE		
Peromyscus leucopus	White-footed Mouse	Oak Woods, Tamarack, Wet Forest, Maple-Birch, Wet Forest, Jack Pine Bog
Clethrionomys gapperi	Gapper's Red-backed Vole	Pine, Oak Woods, Maple-Birch, Wet Forest, Tamarack Wet Forest
Microtus pennsylvanicus	Meadow Vole	Pine, Pine-Tamarack Wet Forest, Shrub/Swamp/Wet Meadow, Tamarack-Birch Wet Forest
ZAPODIDAE		
Zapus hudsonius	Meadow Jumping Mouse	Pine, Tamarack-Birch Wet Forest, Jack Pine Bog, Shrub Swamp, Wet Forest
CERVIDAE		
Odocoileus virginianus	White-tailed Deer	

Results

The results of the 1979 mammal inventory is presented in the form of an annotated list, Table 5. Eleven species, representing six families were observed or captured on Boot Lake.[1]

Sources of Information

Banfield, S.W.F. 1974. The Mammals of Canada. University of Toronto Press, Toronto.

Burt, William H., Richard Grossenheider. 1964. A Field Guide to the Mammals. Houghton Mifflin Company, Boston.

Gunderson, Harvey L. and James K. Bur. 1953. The Mammals of Minnesota. University of Minnesota Press, Minneapolis.

1 Additional information, in the form of field data sheets and secondary sources, is on file, Scientific and Natural Areas Section, St. Paul.

AMPHIBIANS AND REPTILES

Methods

Amphibians and reptiles were identified by vocalizations, sight and collection of specimens.[1] Collection techniques used were drift fences and hand collection. Incidental observations were made throughout the summer.

Collection of amphibians was accomplished by hand capture and with drift fences. In the spring frogs, toads and salamanders congregate for breeding, often in the same areas. Frogs and toads can be identified using their breeding vocalizations, located and hand captured. Salamanders were collected by searching the breeding area. Collecting was done at night with head lamps and waders. Later in the spring and throughout the summer drift fences, ranging from 50 to 100 feet long, were constructed of 18 inch high galvanized flashing sunk 3 to 4 inches into the ground. One bucket was placed at each end of the fence with a pair of buckets along the fence at 15 foot intervals. These served as drop receptacles for amphibians moving along the fence. The fences were placed in low areas and along the shores of water areas. Any animal moving toward or away from the water was diverted by the obstructing fence into one of the drop buckets.

Voucher specimens were deposited at the Bell Museum of Natural History, University of Minnesota, Department of Ecology and Behavior Biology.

Results

The results of the 1979 amphibian and reptile inventory are presented in the form of an annotated list, Table 6. Seven amphibians and 6 reptiles were identified in Boot Lake.

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1 Field work in the spring and early summer was conducted by Scientific and Natural Areas Volunteers, Bruce Brecke and Mike Pappus.

Table 6. Amphibians and Reptiles Observed on Boot Lake Natural Area.

AMPHIBIA

AMBYSTOMATIDAE
Ambystoma laterale (Blue-spotted Salamander)
Ambystoma tigrinum tigrinum (Eastern Tiger Salamander)

BUFONIDAE
Bufo americanus american (American Toad)

HYLIDAE
Hyla crucifer (Spring Peeper)
Hyla versicolor (Gray Tree Frog)
Pseudacris triseriata triseriata (Western Chorus Frog)

RANIDAE
Rana pipiens pipiens (Leopard Frog)
Rana sylvatica (Wood Frog)

REPTIDIA

COLUBRIDAE
Storeria occipitomaculata occipitomaculata (Northern Red-bellied Snake)
Thamnophis sirtalis sirtalis (Eastern Garter Snake)
Thamnophis sirtalis parietalis (Red-sided Garter Snake)
Pituophis melanoleucus sayi (Bullsnake)

EMYDIDAE
Chrysemys picta belli (Western Painted Turtle)
Emydoidea blandingii (Blanding's Turtle)

Sources of Information

Breckenridge, W.J. 1944. Reptiles and Amphibians of Minnesota. The University of Minnesota Press, Minneapolis.

Conant, Roger. 1958. A Field Guide to Reptiles and Amphibians. Houghton Mifflin Company, Boston.

LAND USE HISTORY

Virtually all "natural areas" have been affected to some degree by the activities of people. Farming, grazing, logging, drainage of wetlands, and the suppression of fire are some of the ways people have affected the land. Knowledge of historical land use practices helps explain the present condition of the land and its resources. Surrounding land use practices also affect the viability of all natural areas.

Methods

The land use information presented here is based on historical records, aerial photographs, inspections of the site, and interviews with owners of adjacent land and other individuals knowledgeable about Boot Lake natural area.

Land Use History of Boot Lake Natural Area

People have lived in the vicinity of Boot Lake for centuries. The Mound Builders were the first people recorded living in the area. The Mound Builders' name derives from the symetrical burial mounds they typically built beside a river or lake. One such mound was discovered near the southwest corner of Boot Lake (see Figure 7). A bone of a ten year old child was discovered when a tree was uprooted from the mound, and a full skeleton in sitting position was found immediately south of the mound in the earlier part of this century. Later on, other Indians, probably the Chippewa or Sioux, frequently traversed the land surrounding Boot Lake. A number of arrowheads and hatchets have been found on the land throughout the years, especially on those areas which were plowed.

Europeans first came to the Boot Lake area in the later part of the 1800's. Linwood Township, where Boot Lake is located, was settled in

1855 and organized in 1871. In 1872, 1878, and 1886 three families homesteaded around Boot Lake. These families still own most of the land surrounding the lake (see Figure 7).[1]

With time, parcels of land in the vicinity of Boot Lake were cleared and used for crop production, grazing, or residential housing. Other parcels were utilized for timber and wildlife production. Today woods still stand around much of the tract's border with an occasional cultivated field and house. Corn and soybeans are the most common crops grown in the area. Carlos Avery Wildlife Management Area borders the northeastern, eastern, and southeastern edge of the tract. However, Boot Lake lies in the urban fringe of the Twin Cities Metropolitan Area, and the area around Boot Lake is being rapidly developed. The land just north of the tract, on the south shore of Linwood Lake, is being subdivided and now has residential homes. Houses have also been recently built on Highway 17, south of the tract.

The land immediately adjacent to Boot Lake natural area has been affected in many ways by the activities of people. Figure 7 summarizes the recent land use history of the area. Logging, grazing, haying, and row cropping have all occurred in the area. Several roads and other structures, including a log cabin, were also built near or immediately adjacent to the lake.

Livestock grazing has occurred all around the lake. Letters A-D represent areas which have been grazed. Area "A" was grazed from the 1880's until 1957 by 140 head of Holstein cattle and thirty-five sheep.

1 A description of the changes which have occurred in the Boot Lake ownership is on file, Scientific and Natural Areas Section, St. Paul.

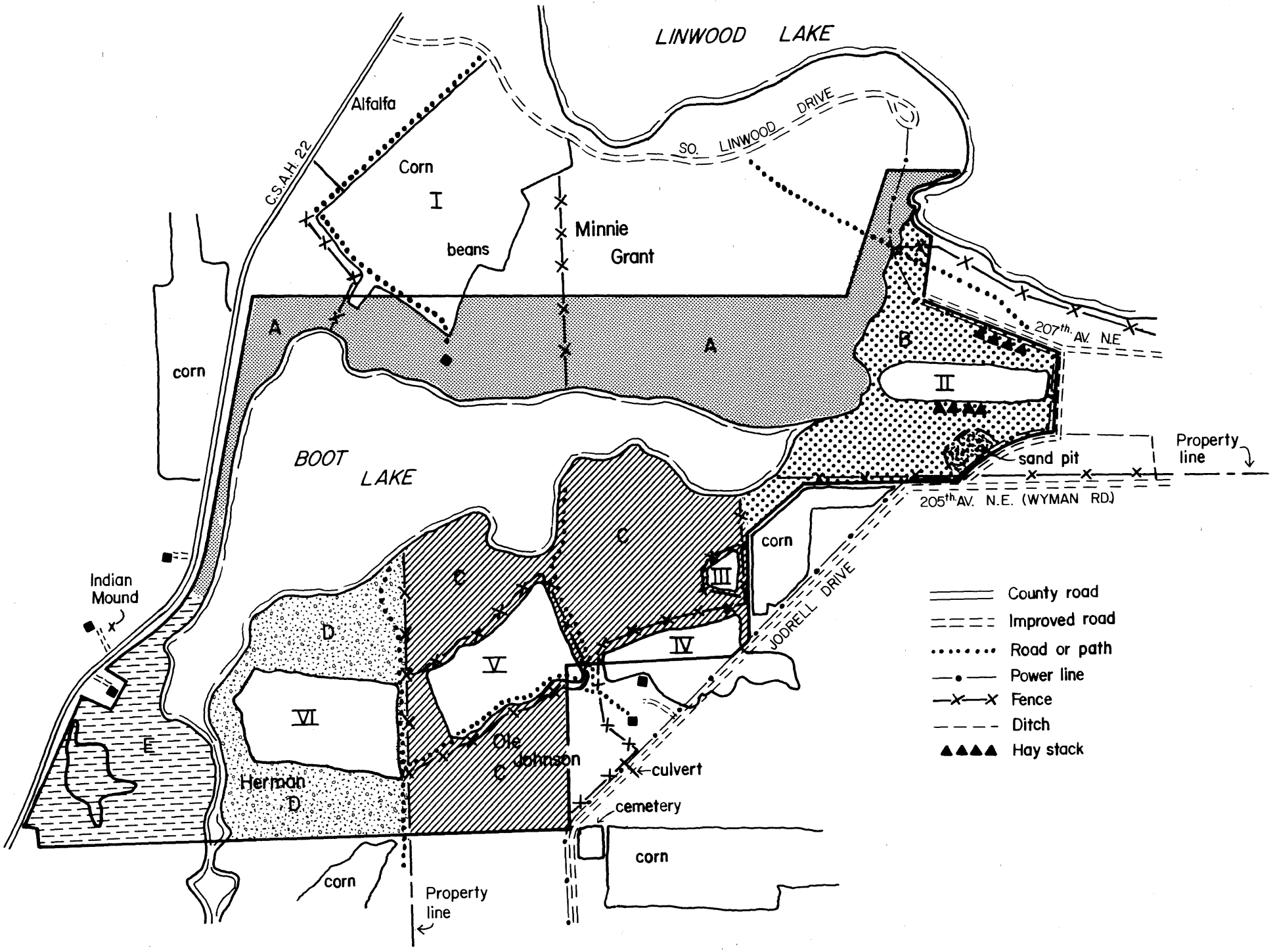

LINWOOD LAKE
SO. LINWOOD DRIVE
C.S.A.H. 22
Alfalfa
Corn
I
beans
Minnie
Grant
A
A
B
II
207th AV. N.E.
corn
BOOT
LAKE
sand pit
Property
line
205th AV. N.E. (WYMAN RD.)
Indian
Mound
C
C
corn
III
D
IV
V
JODRELL DRIVE
VI
E
Ole
Johnson
culvert
Herman
D
cemetery
corn
corn
Property
line
County road
Improved road
Road or path
Power line
Fence
Ditch
Hay stack

Figure 7. Past and present land use practices in the vicinity of Boot Lake

Area "B" was grazed from 1880 to 1957 by twenty-five horses in the fall, after the crops were harvested and the hay stacked. Twenty-six dairy cattle and four horses grazed over Area "C" between 1886 and 1942; eight sheep also grazed in the area, but closer to the southwest corner of Field IV. Area "D" was grazed in the fall by forty head of Holstein cattle from 1878 until about 1930. Area "E" was grazed by an unknown number of dairy cattle and horses between 1880 and 1940.

Two areas were hayed for over fifty years. Swamp grass in Area "B" was mowed every year from 1900 to 1957 with a hand scythe and the aid of horses. Haystacks were kept on the higher ground through the winter and hauled off in the spring. Field VI was alternately used for hay and crop production from 1879 until 1977 when it was planted with alfalfa and red clover and fertilized with potash. Alfalfa and red clover have subsequently been cut twice every year, baled, and hauled off the field.

Six fields have been cultivated near Boot Lake. Field I was farmed from 1872 to 1955. Corn, sugar cane, oats, barley, soy beans, potatoes, clover and alfalfa were all planted on the field at various times. Then for twenty years the field lay fallow. In 1975 corn and soybeans were again planted and have continued to be cultivated up to the present. Lime was used on the field after 1945, but only manure has been used as fertilizer. Field II was planted from 1872 to 1930 with oats. Fields III and IV were planted with a rotation of corn, potatoes, melons, oats and red clover from 1886 to 1961. Field V had a rotation of potatoes, corn and oats also from 1886 to 1961. Corn, hay, soybeans and potatoes were harvested on a rotating basis on Field VI from 1879 to 1977.

In addition to the above crops blueberries were regularly gathered in Areas "A" and "E". From 1879 to 1920 the blueberries, and about 500 bushels of cranberries collected from the bog in "E", were sold by the owners. Spring controlled burns were set in the two areas every two years during this time to maintain the blueberry patches and eliminate competitors.

Parts of areas A-E have also been logged at various times, beginning in the early 1900's. Area "A" apparently experienced the most intensive logging: 350,000 board feet of Poplar, Oak, Jack Pine and some Birch were handcut and hauled off to a nearby lumber mill. A small patch of Maple, Birch and Oak was cut in Area "B". In 1979 dead and dying oaks were also removed from this area: other oaks which arch over Jordell Drive are presently being removed. Timber thieves cut many large White Pines in Area "C" before 1880. In 1886 a few 30 inch diameter at breast height (d.b.h.) White Pines and some Tamarack trees were logged above Field IV. Then in 1961 about fifteen 18-20 inch d.b.h. Jack Pine were removed south of Field V. Area "D" was first logged during homesteading in 1878. Then the entire section above Field VI was logged around 1939; some 12-13 inch diameter White Pine and Jack Pine were cut here. Another timber harvest occurred in Area "D", and in the bog in the northeast section of the bog in Area "E" around 1943: 2000 board feet of white pine were cut. These trees were about forty feet high and 100 years old. One hundred tamarack trees immediately southeast of the bog in Area "E" were also logged in 1943.

Fences were built on all of the areas which were grazed near the lake. The fences in and around Areas "A" and "B" were erected before

1900, probably at the same time the homestead was built in 1872. They were made of small oak and cedar trees with eight strands of barbed wire. Some metal stakes were used to replace rotten wooden posts from about 1925 to 1955. Today, posts may still be found in the two areas. The fences in and around Area "C" were installed in 1886 and kept in repair through 1934. These fences consisted of Yellow Tamarack posts and barbed wire. Parts of the fences are still standing. The barbed wire fence which presently separtes Areas "C" and "D" was erected in 1878. Area "E" was also fenced, but the fence location was not determined.

Several structures were built in the Boot Lake area, some of which remain today. A 12'x16' log cabin was built on the north shore of the lake in 1872, but was moved to the farmstead on the south shore of Linwood Lake in 1910. A path probably led to the house and sedum was planted around it. A root cellar in the southeast corner of Field V was used when the field was being farmed. The cellar has since been filled in with garbage and dirt. Today only a large ten foot pit marks the cellar's location. On the south shore of Boot Lake there are a couple wood planks presently used as a boat dock. A sunken duck blind is located a short distance to the east of the dock. Another duck blind is south of the old homestead site on the north shore. More recently, the Anoka Electric Cooperative erected powerlines which cross the creek on the lakes east side, and border Jordell Drive, Saturn Street and 207th Avenue.

At least five roads have been built in or adjacent to the Boot Lake area. County State Aid Highway 22 (CSAH 22) began as a wagon trail when the homesteads were built. It was a dirt road until 1965 when the county leveled the road, using adjacent earth, and paved it. A section of the old road bordering Field I was abandoned and returned to the landowner.

CSAH 22 has 50 feet right-of-way on each side of the center line. Blue grass, red clover, white clover, birdsfoot trefoil, hairy vetch, timothy, brome grass and perennial rye grass were all planted along the road's sides. The Boy Scouts may also have planted a few conifers on the west side of Boot Lake bordering the road.

Jordell Drive N.E. is a township sand road first used around 1910 as a mail route to Wyoming, Minnesota.

In 1969, 207th Avenue N.E. was built. The sand for this road and parts of the nearby roads, came from the sand pit on the lake's east side. It is not known when this sand pit began operating, but it is still being used today.

A 16 foot wide cartway going from Areas "A" to "B" was built and used in the late 1800's. To cross the stream a bridge 10-12 feet in width was also constructed. The cartway then continued along the south shore of the lake, taking a turn south on what is now Saturn Drive N.E. Corduroy, consisting of pine and tamarack, was placed in two sections of the path. The bridge was used by both livestock and cars until 1942 when the bridge rotted out. Although low standing vegetation covers much of the cartway today, the path can still be recognized.

The sand road between Areas "C" and "D" was built in 1878 and used to connect with Highway 17 to the south. This road is still used as an access to the field and boat dock. An additional segment was added on to the road in 1886, running along the south edge of Field V to a landowner's house. This road is now covered with vegetation and is undistinguishable in the woods, but the ruts in the field can still be seen.

In addition to the above roads many foot paths run through the woods. One path was built in the 1900's to connect Areas "D" and "E". Presently this path is in extremely poor condition because the logs used in the path have rotted.

Several other activities have affected the Boot Lake area. A ditch was built by hand east of Area "B" in 1890 to drain the crop area. The ditch was 2-4 feet wide and several feet deep. However, in 1960 the ditch was plugged up and filled in with earth and grasses; today it is barely recognizable. A beaver dam which blocks the flow of wastes from Boot to Linwood Lake has been blown out several times, most recently in the spring of 1979. This action, in turn, has affected Boot Lake's water level. Finally, all of the Boot Lake area has been used by hunters and snowmobilers. Areas "A" and "B" were leased to the Linwood Gun Club from 1892 to 1978. Blinds were sunk along the north border of Boot Lake in the fall, one of which still remains near the old homestead.

APPENDIX I.

The following is a summary of the species identified in each releve plot during 1979.[1] Relve plots were surveyed twice during the season; the dates and people conducting each survey are given in the heading. If the abundance of a species was recorded differently in the two surveys, the summary includes the greatest abundance noted. Species are grouped into grasses and forbes, or, woody and herb categories. Species are then listed by abundance within each category. A list of the symbols used in recording releve data are given below. Data is recorded in the following format:

Species name — height class / cover-abundance/sociability

SYMBOLS USED FOR RELEVE DESCRIPTIONS

Height Class (Stratification)

8	35 m
7	20 - 35 m
6	10 - 20 m
5	5 - 10 m
4	2 - 5 m
3	1 - 2 m
2	.5 - 2 m
1	0 - .5 m

Coverage for Height Classes

75%	continuous
50 - 75%	interrupted
25 - 50%	parklike, patchy
5 - 25%	sparse
5%	sporatic to very scarce

Cover-abundance, for species

r	single occurrence
+	occasional, cover 1%
1	plentiful, cover 1-5%
2	very numerous, cover 5-25%
3	any number of individuals, cover 25-50%
4	any number of individuals, cover 50-75%
5	any number of individuals, cover 75-100%

Sociability (dispersion)

1	growing singly
2	grouped, few individuals
3	large group, many individuals
4	small colonies, extensive patches, broken mat
5	extensive mat

Certainty of Identification

(no notation)	positive
?	some doubt

1 The scientifc names in the releve data are from field notes and do not necessarily follow the nomenclature of Gleason and Cronquist (1963).

DATE: June 5 / Aug 31 1979 SURVEYOR: Lustig

PLOT #: 1 Boot Lake

LOCATION:

COVER TYPE: oak forest Quercus ellipsoidalis - Q. alba

SOIL SERIES:

PLOT SIZE: 20x20 meters

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1
			25-50%	5-25%	5%	25-50%	5-25%	50-75%

Species	8	7	6	5	4	3	2	1	Remarks
Quercus ellipsoidalis			3/1					+/1	note: dd +/1 in height 7
Quercus alba			1/1				+/1	+/1	
Prunus serotina				1/1		1/1	1/1		
Acer rubrum				+/1			1/1	+/1	
Populus grandidentata				+/1					
Amelanchier laevis					+/1	2/1			
Pinus strobus						+/1		+/1	
Betula papyrifera						+/1	+/1		
Xanthoxilum americanum							+/1		
Pteridium aquilinum								3/1	
Uvularia sessifolia								2/1	
Maianthemum canadense								2/1	
Parthenocissus inserta								1/1	
Rhus radicans								1/1	
Trientalis borealis								1/1	
Vaccinium angustifolium								1/1	
Rubus strigosus								+/1	
Vitis riparia								+/1	
Rosa suffulta								+/1	
Prunus virginiana								+/1	
Dryopteris spinulosa								+/2	
Carex pennsylvanica								+/2	
Aralia nudicaulis								+/1	
Chimaphila umbellata								+/1	
Pyrola elliptica								+/1	
Galium boreale								+/1	
Aquilegia canadensis								+/1	
Anemone quinquefolia								+/1	
Corylus americana								+/1	
Circaea quadrisulcata								+/1	
Amphicarpa bracteata								+/1	
Rubus occidentalis								+/1	
Smilacena racemosa								+/1	

(June 5, June 14)

DATE: August 23 1979 SURVEYOR: Lustig

PLOT #: 2 Boot Lake

LOCATION:

COVER TYPE: old field Agropyron repens -

SOIL SERIES:

PLOT SIZE: 20x20 meters

Height Classes

	8	7	6	5	4	3	2	1
Coverage for Height Class -								75%

Species	Remarks
Agropyron repens	5/1
Oenothera parviflora	1/1
Rumex acetosella	1/1
gopher hole	1/2
Silene antirrhina	+/1
Agrostis scabra	+/3
Lepidium densiflorum	+/1
Conyza canadensis	+/1
Polygonum convolvulus	+/1
Asclepias syrica	+/1
Panicum oligosanthes var. scribnerianum	+/1
Polygonum pensylvanicum	r/1
Ambrosia artemesiifolia	+/1
Tragopogon dubius	r/1
Gnaphilum obtusifolium	r/1

(June 5, June 14)

DATE: ~~September~~ 4 1979 SURVEYOR: Lustig

PLOT #: 3 Boot Lake

LOCATION: (alder - tamarack)

COVER TYPE: Larix laricina - Alnus rugosa wet forest

SOIL SERIES:

PLOT SIZE: 20 x 20 meters

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1
			5-25%	5%	5-25%	5%	5%	50-75%

Species	8	7	6	5	4	3	2	1	Remarks
Larix laricina			+/1	1/1				r/1	
Pinus strobus				+/1					
Alnus rugosa					2/2		+/2		
Ilex verticillata					1/1		+/1	+/1	
Rhus vernix					1/1			+/1	
Betula papyrifera					1/1				
Salix cf serrissima					r/1				?
Nemopanthus mucronatus						+/1	1/1	+/1	
Lonicera dioica							+/1		
Calamogrostis canadensis							+/1		
Sphagnum spp.								3/4	
Carex lacustris								3/2	
Mainthemum canadense								2/1	
Carex disperma								1/2	
Calamogrostis canadensis								1/2	
Cypripedium acaule								1/1	
Osmunda cinnamomea								+/2	
Acer rubrum								+/1	
Rubus pubescens								+/1	
Trientalis borealis								+/1	
Thelypteris palustris								+/2	
Bidens cf. frondosa								+/1	?
Rumex orbiculatus								+/1	
Dryopteris cristata								+/2	
Caltha palustris								+/1	
Equisetum fluviatile								+/1	
Cicuta bulbifera								+/1	
Ledum groelandicum								+/1	
Ribes cf hirtellum								+/1	?
Potentilla palustris								+/1	
Impatiens capensis								+/1	
Viola pallens								+/1	
Galium cf triflorum								+/1	?
Pyrola sp.								+/1	?
Dryopteris spinulosa								+/2	
Partheno cissus inserta								+/1	

DATE: _____ SURVEYOR: _____

PLOT #: 3 Boot Lake continued

LOCATION: _____

COVER TYPE: _____

SOIL SERIES: _____

PLOT SIZE: _____

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1

Species									Remarks
Lycopus uniflorus								+/1	
Rubus strigosus								+/1	
Stellaria longifolia								+/1	
Aralia nudicaulis								+/1	
Polygonum sagittatum								+/1	
Sagittaria latifolia								+/1	
Lysimachia thyrsiflora								+/1	
Gymnocarpium dryopteris								+/1	
Arenaria lateriflora								+/1	
Gaylussaccia baccata								+/1	
Campanula aparinoides								+/1	
Scutellaria lateriflora								+/1	
Aster puniceus								+/1	
Pilea fondosa								+/1	
Cornus canadensis								+/1	
Onoclea sensibilis								+/1	
Vaccinium angustifolium								r/1	
Taraxacum officinale								r/1	
Lonicera villosa								r/1	
Hypericum virginicum								r/1	
Quercus cf borealis								r/1	?
Mnium sp								+/4	

DATE: June 5 Sept. 4. 1979 SURVEYOR: Lustig

PLOT #: 4 Boot Lake

LOCATION:

COVER TYPE: oak forest Quercus ellipsoidalis - Quercus alba

SOIL SERIES:

PLOT SIZE: 20 x 20 meters

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1

Species	8	7	6	5	4	3	2	1	Remarks
Quercus ellipsoidalis		2/1			+/1				some dd
Quercus alba		1/1	+/1						occasionally 2/2
Betula papyrifera		+/1							
Pinus strobus				+/1					
Prunus serotina				r/1	1/1	+/1			
Acer rubrum					2/1	+/1	1/1	+/1	
Xanthoxilum americanum					1/1		+/1	+/1	
Amelanchier laevis					+/1			+/1	
Ribes cyanosbati							+/2		
Ilex verticillatus							+/1	+/1	
Aster macrophyllus								4/1	
Parthenocissus inserta								3/1	
Carex pennsylvanica								3/2	
Vaccinium angustifolium								2/1	
Galium triflorum								2/1	
Amphicarpa bracteata								2/1	
Rubus strigosus								1/1	
Mainthemum canadense								1/1	
Junipenus communis var. depressa								1/2	
Trientalis borealis								+/1	
Phryma leptostachya								+/1	
Circaea quadrisulcata								+/1	
Rubus occidentalis								+/1	
Anemone quinquifolia								+/1	
Apocynum androsaemifolium								+/1	
Quercus cf ellipsoidalis								+/1	?
Vitis riparia								+/1	
Lathyrus ochroleucus								+/1	
Smilacina racemosa								+/1	
Arenaria lateriflora								+/1	
Fragaria vesca								+/1	
Uvularia sessifolia								1/1	
Cornus alternifolia								+/1	
Galium boreale								+/1	
Pyrola secunda								+/1	
Aquilegia canadensis								r/1	

June 6

DATE: Aug. 23 1979 SURVEYOR: Lustig

PLOT #: 5 Boot Lake

LOCATION:

COVER TYPE: Clearing

SOIL SERIES:

PLOT SIZE: 20x20 meters

Height Classes

Coverage for Height Class –	8	7	6	5	4	3	2	1
							5-25%	75%

Species	Remarks
Andropogon scoparius	2/2
Poa pratensis	3/1 note august 20 #4
Rumex acetosella	2/1
Lespedeza capitata	1/1
Agropyron repens	+/1
Achillea millefolium	+/1
Asclepias syrica	+/1
Erigeron annus	+/1
Conyza canadensis	+/1
Hieraculum longipilum	+/1
Panicum cf oligosanthes var. scribnerianum	+/1 ?
Potentilla recta	+/1
Quercus cf ellipsoidalis	+/1 ?
Rosa suffulta	+/1
Smilacina stellata	+/1
Solidago cf gigantea	+/1 ?
Tragopogon dubius	+/1
Verbena stricta	+/1
Gnaphilum obtusifolium	+/1
Cyperus filiculmis	+/1
Prunus virginiana	r/1
Rubus flagellaris	r/1
Taraxacum officinale	r/1

June 6

DATE: Aug. 31, 1979 SURVEYOR: Lustig

PLOT #: 6 Boot Lake

LOCATION:

COVER TYPE: Shrub thicket Cornus stolonifera-Salix gracilis (Salix spp.)

SOIL SERIES:

PLOT SIZE: 20x20 meters

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1
		<5%		5%	5-25%	25-50%	25-50%	50-75%

Species	8	7	6	5	4	3	2	1	Remarks
Larix laricina		+/1						+/1	dd in height 7
Betula pumila				+/1	+/1		+/1	+/1	p
Salix discolor				+/1	+/1				
Salix bebbiana				+/1	+/1			r/1	
Fraxinus pennsylvanica				r/1					
Alnus rugosa				+/2					
Salix serissima									
Salix gracilis					1/2	1/2			
Cornus stolonifera					+/2	+/2	2/2	+/2	
Phalaris arundinacea							2/2		
Osmunda regalis							+/2	1/2	
Bidens coronata							+/1	+/1	
Ribes americanum							+/1		
Urtica dioica							+/1	+/1	
Rubus strigosus							+/1		
Glyceria stricta								2/2	
Lemna minor								1/4	
Impatiens capensis								+/1	
Thelypteris palustris								+/2	
Polygonum coccineum								+/1	
Cicuta bulbifera								+/1	
Stellaria longifolia								+/1	
Geum allepicum								+/1	
Polygonum sagittatum								+/1	
Dryopteris cristata								+/2	
Viola sp.								+/2	?
Athyrium felix-femina								+/2	
Onoclea sensiblis								+/1	
Carex stipata								+/3	
Lysimachia thyrsiflora								+/1	
Ribes hirtellum								+/1	
Lycopus uniflorus								+/1	
Partheno cissus inserta								+/1	
Epilobium glandulosum								+/1	
Carex comosa								+/3	
Aster puniceus								+/1	
Pilea fontana								+/1	

DATE: _____ SURVEYOR: Lusth

PLOT #: 6 Boot Lake continued

LOCATION: _____

COVER TYPE: _____

SOIL SERIES: _____

PLOT SIZE: _____

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1

Species	8	7	6	5	4	3	2	1	Remarks
Campanula aparinoides								+/1	
Scutellaria galericulata								+/1	
Lycopus americana								+/1	
Rhus vernix							r/1		
Rumex orbiculatus								r/2	
Solidago gigantea								r/1	
Galium tinctorum								r/1	

Juneb

DATE: Sept 4 1979 SURVEYOR: Lustig

PLOT #: 7 Boot Lake

LOCATION: ~~(white pine - tamarack)~~

COVER TYPE: Pinus strobus - Larix laricina - wet forest

SOIL SERIES:

PLOT SIZE: 20 x 20 meters

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1
		25-50%	5%	5%	5-25%	5-25%	<5%	75%

Species	8	7	6	5	4	3	2	1	Remarks
Larix laricina		2/1							
Pinus strobus		+/1		+/1					
Acer rubrum			+/1		+/1			+/1	
Betula papyrifera				r/1	+/1			+/1	
Ilex verticillata					+/1	1/1	+/1	+/1	
Nemopanthus mucronata					1/1	+/1	+/1		
Aronia melanocarpa					+/1				
Rhus vernix							1/1	+/1	
Rhamnus frangula							+/1	+/1	
Osmunda cinnamomea							+/2	2/2	
Eriophorum virginicum							+/1		
Sphagnum sp.								3/4	?
Dulichium arundinaceum								2/1	
Carex canescens								1/4	
Vaccinium angustifolium								1/1	
Hypericum virginicum								+/1	
Chamaedaphne calyculata								+/1	
Dryopteris spinulosa								+/1	
Equisetum fluviatile								+/1	
Galium trifidum								+/1	
Ledum groelandicum								+/1	
Lycopus uniflorus								+/1	
Mainthemum canadense								+/1	
Menyanthes trifoliata								+/1	
Quercus cf ellipsoidalis								+/1	?
Rubus pubescens								+/1	
Spiraea tomentosa								+/1	
Thelypteris palustris								+/1	
Trientalis borealis								+/1	
Polygonum punctatum								+/1	
Vaccinium myrtilloides								+/1	?
Viola sp.								+/1	
Sagittaria latifolia								1/1	
Pinus strobus		- 80						r/1	

June 6

DATE: Sept 4, 1979 SURVEYOR: Lustig

PLOT #: 8 Boot Lake

LOCATION: (tamarack - birch)

COVER TYPE: Larix laricina - Betula papyrifera wet forest

SOIL SERIES:

PLOT SIZE: 20x20 meters

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1
		5-25%	25-50%	5%	50-75%	<5%	<5%	75%

Species	8	7	6	5	4	3	2	1	Remarks
Larix laricina		2/1	2/1	2/1	+/1	+/1	+/1	+/1	
Betula papyrifera			2/2		+/1		+/1	+/1	dd on Aug. 20, 7< with r/2 ative
Pinus strobus				1/1				+/1	
Acer rubrum				+/1	+/1		+/1	+/1	
Ilex verticillatus					2/1			+/1	
Nemopanthus mucronatus					+/1				
Quercus cf ellipsoidalis					+/1			+/1	?
Rhus vernix							+/1	+/1	
Rhamnus frangula							+/1	+/1	
Carex oligosperma								2/1	
Sphagnum sp.								5/5	?
Vaccinium angustifolium								2/3	
Osmunda cinnamomea								1/2	
Chamaedaphne calyculata								+/1	
Dryopteris spinulosa								+/2	
Dryopteris cristata								+/1	
Ledum groelandicum								+/1	
Rubus cf pubescens								+/1	?
Thelypteris palustris								+/2	
Erechtites hieracifolia								+/1	
Spiraea tomentosa								+/1	
Eriophorum virginicum								+/1	
Osmunda regalis								r/2	
Polytrichum sp.								r/4	?

DATE: June 6 Sept 14 1979 SURVEYOR: Lustig

PLOT #: 9 Boot Lake

LOCATION:

COVER TYPE: Pinus banksiana bog (jack pine bog)

SOIL SERIES:

PLOT SIZE: 20x20 meters

Height Classes

	8	7	6	5	4	3	2	1
Coverage for Height Class -		5-25%	5% 25%		5%	5%	5% 25%	75%

Species	8	7	6	5	4	3	2	1	Remarks
Pinus banksiana		2/1	1/1					1/1	
Larix laricinia					1/1	+/1	+/1	+/1	
Alnus rugosa					+/2	1/2	1/2	1/2	
Betula pumila							1/1	+/1	
Scirpus cyperinus							+/1		
Sphagnum sp.								5/5	?
Eriophorum angustifolium								3/1	
Vaccinium angustifolium								2/3	
Andromeda glaucophylla								+/1	
Carex cf oligosperma								+/2	?
Chamaedaphne calyculata							+/1	+/1	
Quercus cf ellipsoidalis								+/1	?
Vaccinium oxycoccos								+/1	
Polygonum sagittatum								+/1	
Populus tremuloides								r/1	

DATE: June 6 1979 SURVEYOR: Lustig

PLOT #: 10 Boot Lake

OCATION:

COVER TYPE: maple-birch wet forest
Acer rubrum - Betula papyrifera - (Pinus strobus) wet forest

SOIL SERIES:

PLOT SIZE: 20x20meters

Height Classes

Coverage for Height Class -	8	7	6	5	4	3	2	1
		5-25%	25-50%	5-25%	5-25%	5%	50-75%	25-50%

Species	8	7	6	5	4	3	2	1	Remarks
Betula papyrifera		2/1					+/1	+/1	
Acer rubrum			2/1	2/1	+/1		+/1	+/1	
Pinus strobus			2/1			r/1		+/2	
Alnus rugosa					+/1		+/2		
Cornus alternifolia					+/1	+/1	+/1	+/1	
Rhus vernix					+/1	+/1			
Prunus virginiana					+/1		+/1	r/1	
Osmunda cinnomomea							4/2		
Ilex verticillata							r/1	+/1	
Aralia nudicaulis								1/1	
Athyrium felix-femina								1/2	
Parthenocissus inserta								1/1	
Vaccinium angustifolium								1/2	
Circaea alpina								+/2	
Coptis groelandicum								+/1	
Clintonia borealis								+/1	
Dryopteris spinulosa								+/2	
Galium triflorum								+/1	
Geranium maculatum								+/1	
Impatiens capensis								+/1	
Mainthemum canadense								+/1	
Osmorhiza claytoniana								+/1	
Osmunda regalis								+/1	
Quercus cf ellipsoidalis								+/1	?
Ribes americanum								+/1	
Rubus strigosus								+/1	
Trientalis borealis								+/1	
Trillium cernum								+/1	
Urtica dioica								+/1	
Viola sp.								+/1	?
Aralia racemosa								r/1	
Botrychium virginianum								r/1	
Vitis riparia								r/1	

Addendum # 1
Feb 1, 1982

LOCAL PERSPECTIVE

LOCAL PERSPECTIVE

Linwood Township (The following discussion is summarized from the Linwood Township Comprehensive Plan, 1979)

Boot Lake SNA is located in Linwood Township in the extreme northern fringe of the Metropolitan Area, approximately 40 miles from the Twin Cities. The township is served by Interstate 35 which parallels the eastern boundary. CSAH 22 provides east-west access through Linwood. Within the context of the Twin Cities Metropolitan Area, Linwood Township serves the primary function of providing housing in a rural, open space environment. The general community objectives for Linwood are:

1. Protect, preserve and enhance the community's natural/rural environment avoiding the creation of an 'urban' environment and sustaining the existing low density 'rural' suburban growth pattern.

2. To avoid the creation of an urban environment, growth shall be regulated so that the need for a premature extension of sewer service can be avoided.

Linwood has been experiencing unprecedented growth pressures in recent years. Single family homes are the predominant housing type. Map # shows the land-use development plan for Linwood Township. Map# shows how Linwood plans to direct anticipated growth. The west side of Boot Lake SNA is a primary growth staging area. Residential development and expansion of community services will be focused in this type of area. Minimum lot size is 2 1/2 acres.

The rest of the private land surrounding the SNA is planned a residential/agricultural district. Minimum lot size is 5 acres. This can be appealed to 2.5 acres with proof of adequate soil service capability and evidence that such a development will not result in rapid urbanization.

Local road development could affect the SNA. The new road proposed south of the SNA (see map) crosses a lowland area contiguous with the SNA, and also could have an impact on the type of development that would occur adjacent the southern boundary of the SNA (See adjacent resources, Area 5, pg).

Carlos Avery Wildlife Management Area (WMA)

Adjoining the eastern boundary of Boot Lake SNA is the Carlos Avery WMA (21,713 acres). The WMA includes upland woods, lowland forests, old fields, cropland and large wetlands. It was established to provide public hunting for sportsmen in the Twin Cities. It is administered by the DNR, Section of Wildlife. In the past it has been managed principally for waterfowl with secondary emphasis on white tailed deer, squirrels and ruffed grouse and fur-bearers. Hunting and trapping are the dominant recreational uses (DNR, 1977). The management area also provides a variety of other wildlife-oriented outdoor recreation. A large sanctuary area within the WMA occurs just southeast of Boot Lake (see map #).

The WMA headquarters is located about 1 1/2 miles SE of the SNA. Heavy equipment used on the WMA and in the region is stored here. This includes farm equipment, equipment used to construct and maintain roads and firebreaks, manipulate wildlife habitat, build dikes and water control structures.

Prescribed burning has been used extensively on the WMA. It has been applied to the management of wetlands and upland grasslands. Prescribed burning is also planned for savanna areas within the WMA.

The DNR, Division of Forestry maintains its Metro Region headquarters, Carlos Avery District Headquarters and a nursery in the WMA. (See map#)

Martin-Island-Linwood Regional Park

The Metropolitan Council expects this to be a heavily used park when development is completed. It will offer family camping (100 sites) swimming and boating. (see map). A swimming beach, picnic area, nature study area and trails are proposed to be developed in the south end of the park nearest the SNA. Development is scheduled for 1985.

VISITORS AND USE

Past Use

Before SNA designation, public recreational use was confined to Boot Lake itself. The lake was used for both summer and winter fishing, harvesting of wild rice, and snowmobiling. The upland areas were in private ownership. The land on the north and east sides of the lake were leased to a gun club.

Present Use

Since SNA designation, no effort has been made to gather information on user numbers or characteristics.

Use and Activity Problems

Borrow pit area. The lower part of this area was heavily disturbed by sand removal. The upper portions are dominated by prairie species. The entire area was once a cultivated field. Hieracium longipilum occurs on the upland part.

The area next to the road is commonly used as a vehicle turn-around. Tracks indicate vehicles drive all over the lower pit area. Some also drive up onto the upper prairie. The area is also used for target practice and trash dumping.

Wild rice. Wild rice has been traditionally harvested off Boot Lake in the past. The area conservation officer reports that on occasion the lake has been harvested illegally before the season or at night. Further harvesting of the rice is not allowed under SNA policies.

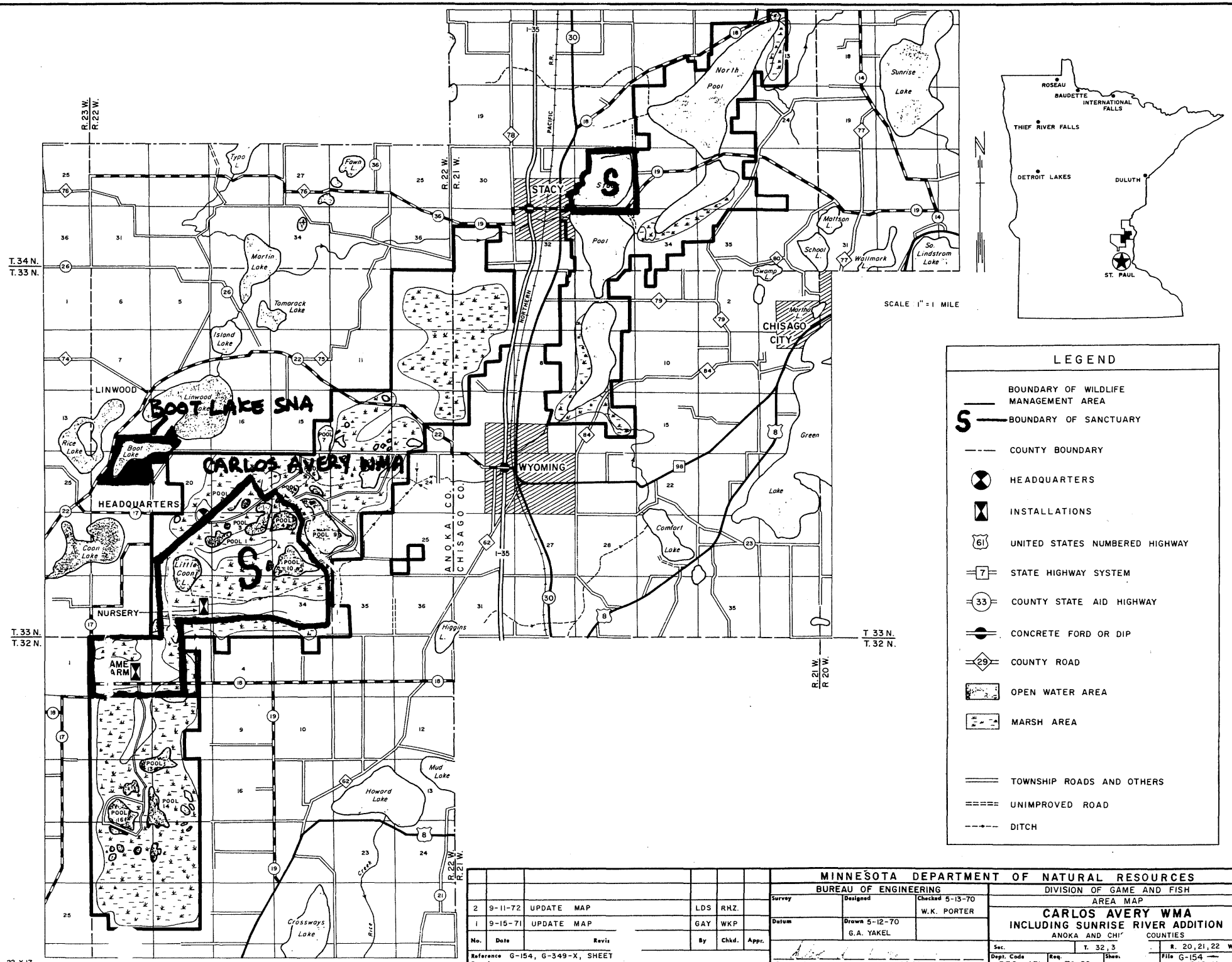
Fishing-Boating. Since designation some fishing or boating has apparently taken place on Boot Lake. A fish house was reported on the lake during the winter of 1980-81. Evidence of a boat being slid into the water from CSAH 22 was also noted fall of 1981.

Boat launching on Linwood Lake. During the summer of 1981 boats were being launched onto Linwood Lake from SNA property. The boats were brought up the trail that starts at the west end of 207th Ave NE. The county has lot #1 of Grants Linwood Shores (adjacent the SNA) for the purposes of public access. This access however has not yet been developed.

Linwood Lake trail. A trail exists along the shore of Linwood Lake between houses on the north side of the Boot Lake outlet and houses on the south. It follows an old road bed. A small bridge across the creek was built by local youths. The trail is situated on peat soils. As mentioned previously, the southeast side of the trail is used for boat access onto Linwood Lake. A small fire ring is present at the landing. The trail is also used by foot traffic and a 3-wheeled ATV. These activities have caused ruts, puddles and loss of ground cover along the trail. With the development of the county park on the east side on Linwood Lake it is expected that use of the trail will increase considerably. Development plans for the county park call for a picnic area and swimming beach near the southeast shore of Linwood Lake (See also Martin, Island, Linwood Regional Park, pg).

Snowmobiling. In the past a heavily used snowmobile trail went from E.J's bar south of the SNA across Boot Lake, to Linwood Lake and up to Martin Lake. The last few years prior to 1981-82 have been poor snow seasons. Snowmobile use in general has been low. During the 1981-82 winter snowmobiles have been observed using the south side of Boot Lake in .

Hunting. During the 1981 hunting season there was one report of hunters coming off SNA land onto private adjacent property. The 1981 season was the first year the area had been posted as a "restricted area, no hunting allowed."



No.	Date	Revis	By	Chkd.	Appr.
2	9-11-72	UPDATE MAP	LDS	RHZ.	
1	9-15-71	UPDATE MAP	GAY	WKP	

Reference Drawings G-154, G-349-X, SHEET

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
BUREAU OF ENGINEERING
DIVISION OF GAME AND FISH

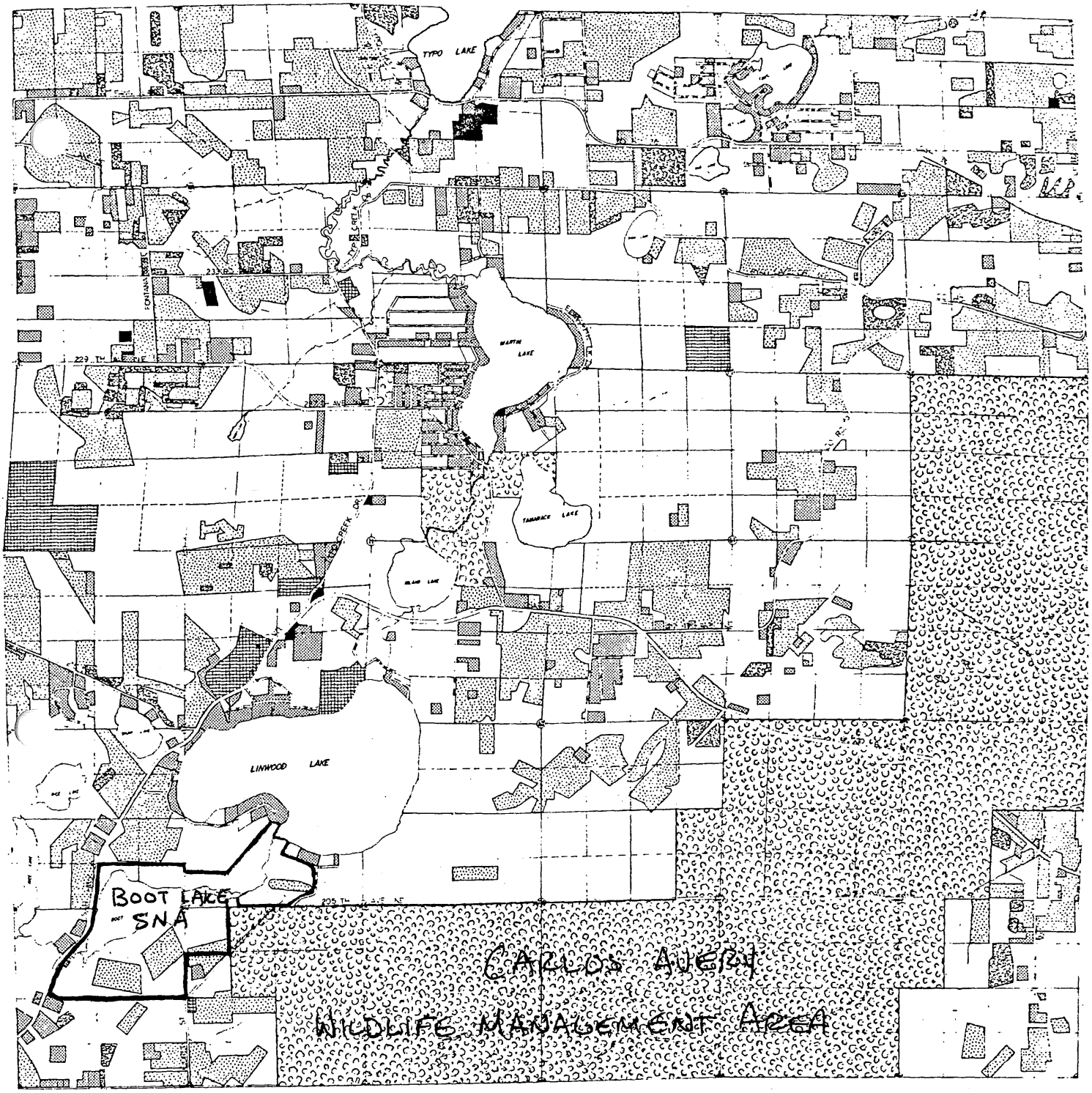
Survey | Designed | Checked 5-13-70 W.K. PORTER
Datum | Drawn 5-12-70 G.A. YAKEL
Date | Administrator

AREA MAP

CARLOS AVERY WMA
INCLUDING SUNRISE RIVER ADDITION
ANOKA AND CHI[illegible] COUNTIES

Sec. | T. 32, 3 | R. 20, 21, 22 W.
Dept. Code REG-431 | Req. 70-20 | Sheet 2 | File G-154 G-349-X

22 X 17



Vacant/Undeveloped

Croplands

Residential

Public/Semi Public

Pine Groves

Public Open Space

Commercial/Industrial

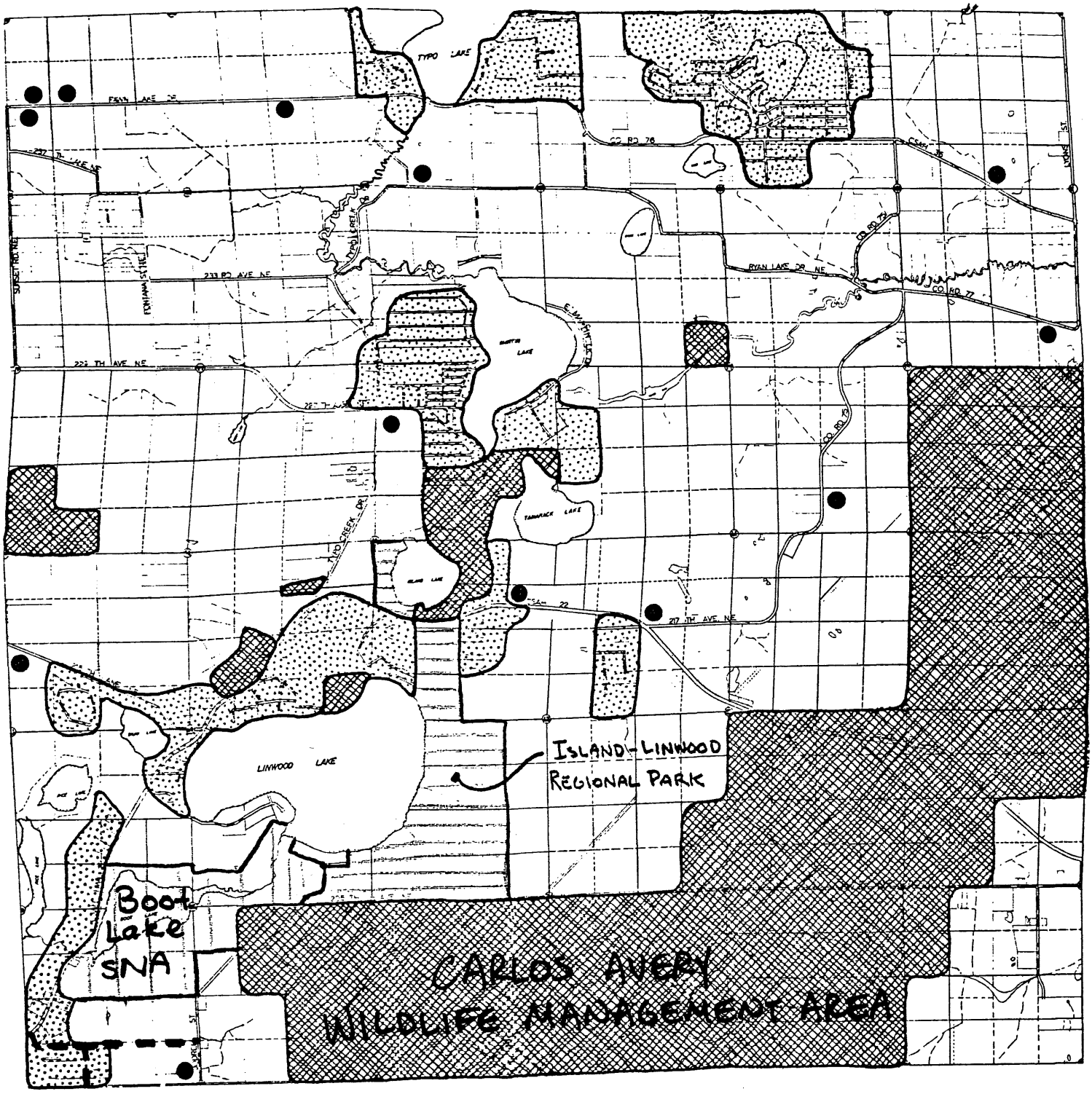
Midwest Planning Research

EXISTING LAND USE

LINWOOD TOWNSHIP

800' 0' 1600' 3200 1 Mi N

This map is for planning purposes only and should not be used when precise measurement is required.



Primary growth staging areas

Residential/agricultural districts

Public and semi public

Existing farmsteads

Future roads

Midwest Planning/ Research

GROWTH STAGING PLAN

LINWOOD TOWNSHIP

800' 0' 1600' 3200' 1MI N

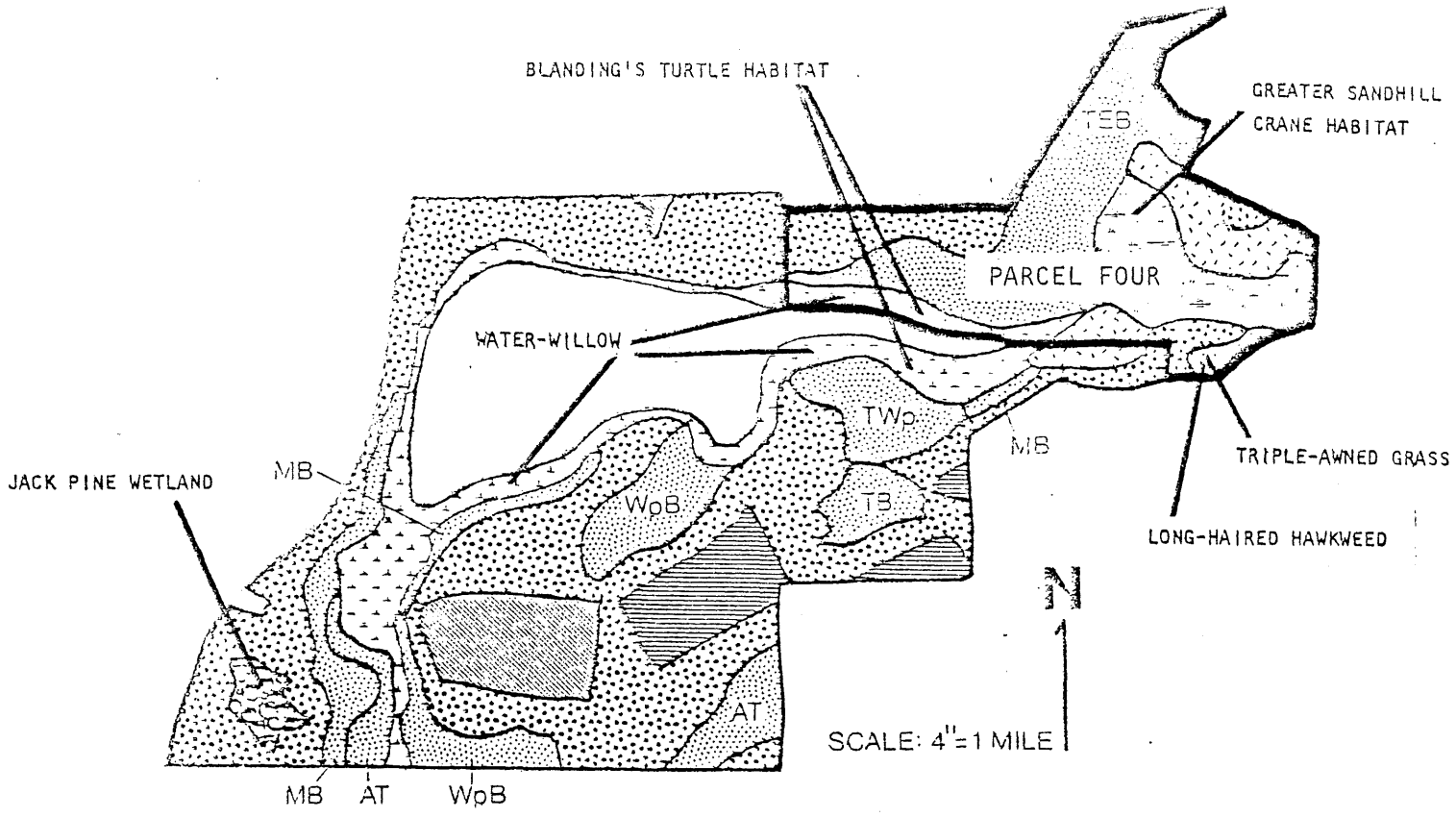
This map is for planning purposes only and should not be used when precise measurement is required.

REV. 4-79 VJH

Addendum # 2

Feb 1, 1982

ELEMENT STATUS SHEETS



KEY

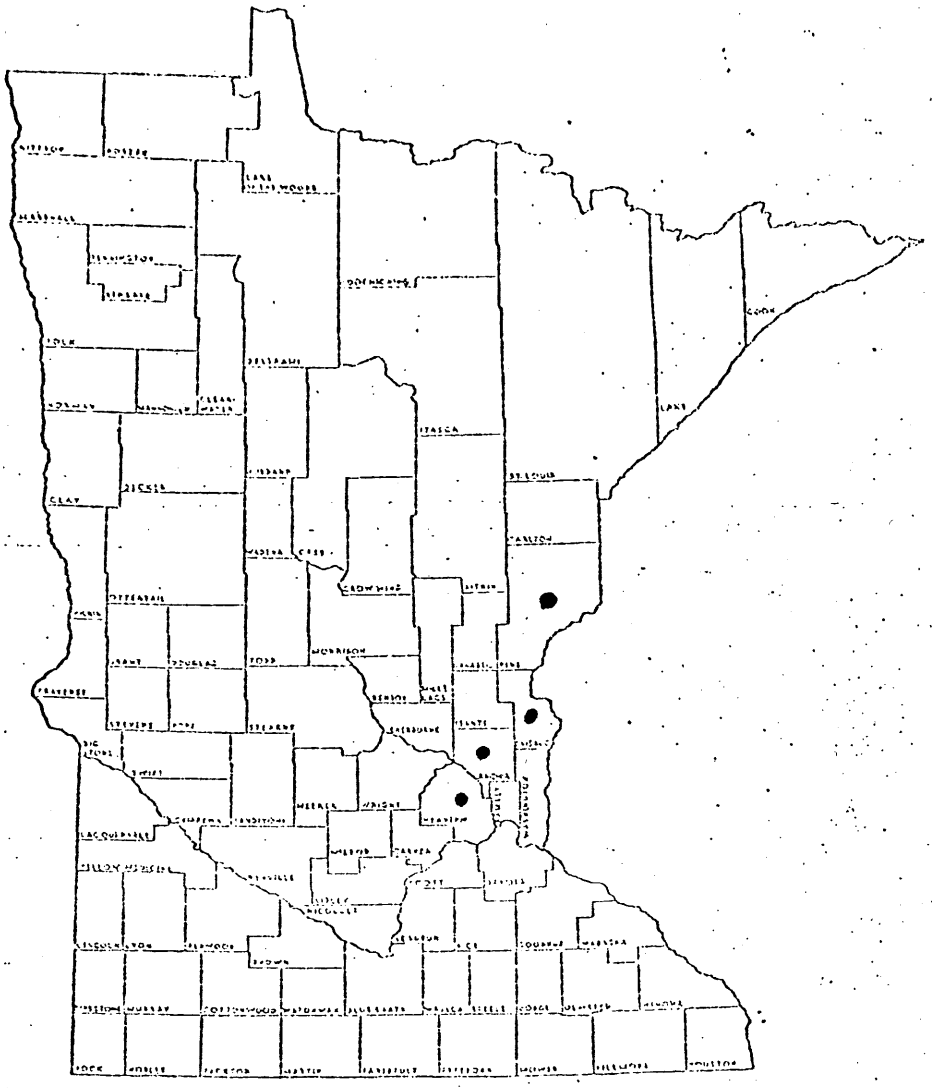
	Oak Forest		Shrub Thicket
TEB	Tamarack-Elm-Birch Wet Forest		Old Field
TWp	Tamarack-White Pine Wet Forest		Cultivated Field
MB	Maple-Birch Wet Forest		Clearing
AT	Alder-Tamarack Wet Forest		Wet Meadow
WpB	White Pine-Birch Wet Forest		Floating Mat/Emergents
TB	Tamarack-Birch Wet Forest		Water (Open)
	Jack Pine Bog		

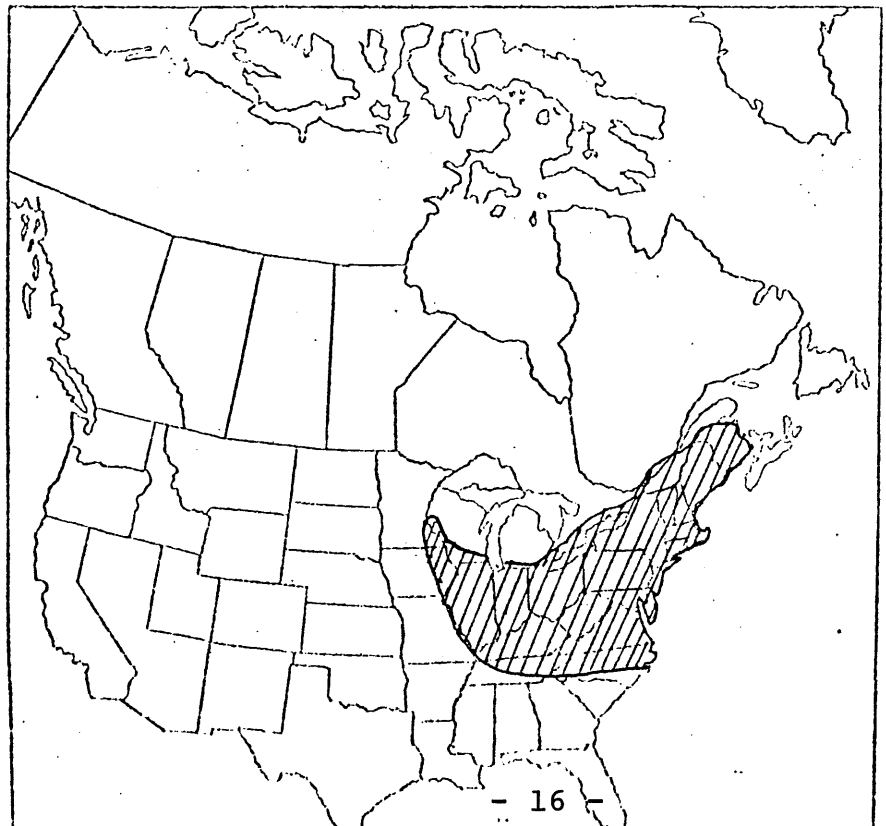
Figure 2. Vegetation Communities, Element occurrences and "Parcel Four" on the Boot Lake project area.

STATUS SHEET

ELEMENT NAME:	Decodon verticillatus; (Water-willow)
FEDERAL STATUS:	None
STATE STATUS:	None
NATURAL HERITAGE PROGRAM STATUS:	Rare
BASIS FOR STATUS CLASSIFICATION:	This species is limited in range to a narrow band of four counties in east central Minnesota. Even within this range it is seen infrequently and usually in low numbers. A number of potential sites for this species have recently been destroyed by urban construction projects.
PREFERRED HABITAT:	Bog margins and lake shores.
DISTRIBUTION:	See attached maps.
OCCURRENCES IN MINNESOTA:	Decodon verticillatus is known from one site each in Pine, Chisago and Anoka counties and two sites in Hennepin county. The Hennepin county sites have not been verified for several years and may have been destroyed by urban development.
# OF OCCURRENCES IN MANAGED AREAS:	The only occurrence of Decodon verticillatus in a managed area is at Cedar Creek Natural History Area.
POTENTIAL THREATS:	Decodon verticillatus is threatened by any activity that would alter its aquatic environment. This would commonly include draining, filling and nutrient enrichment.

Distribution of Decodon verticillatus; (Water-willow)

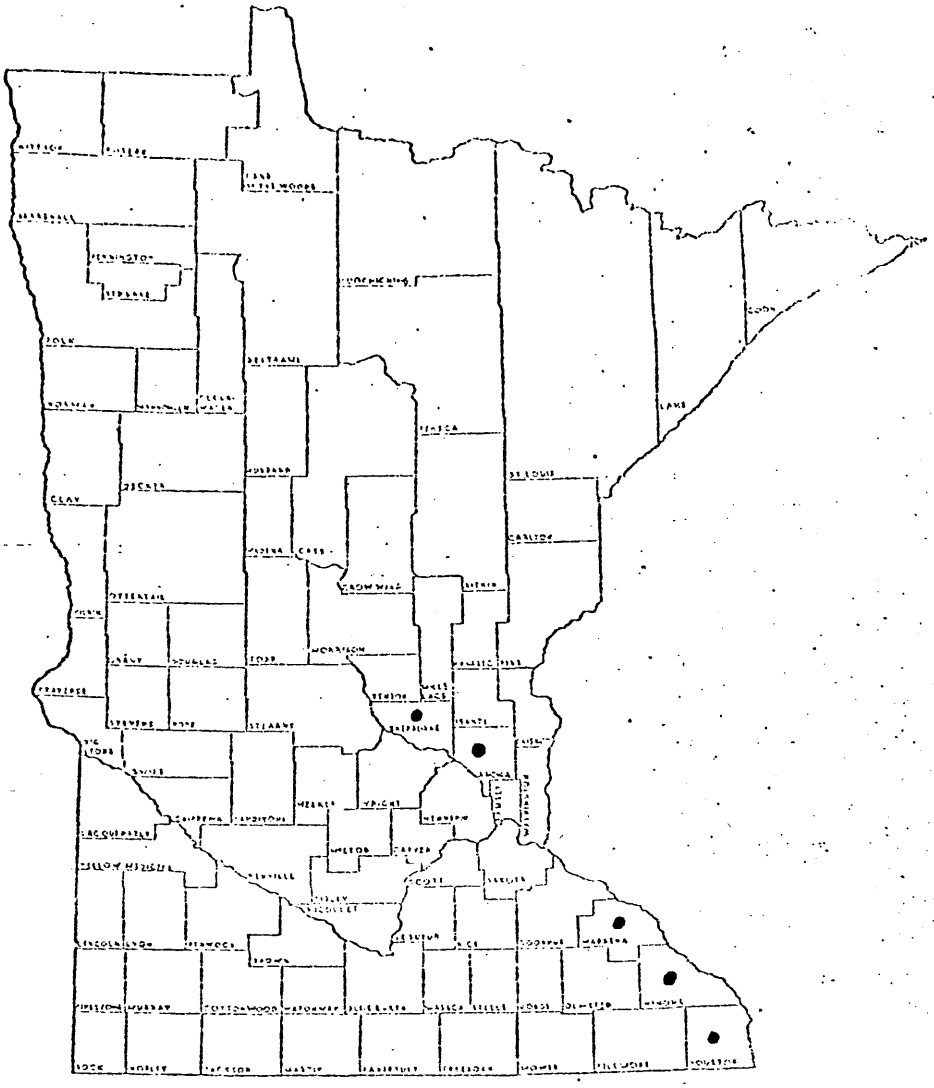


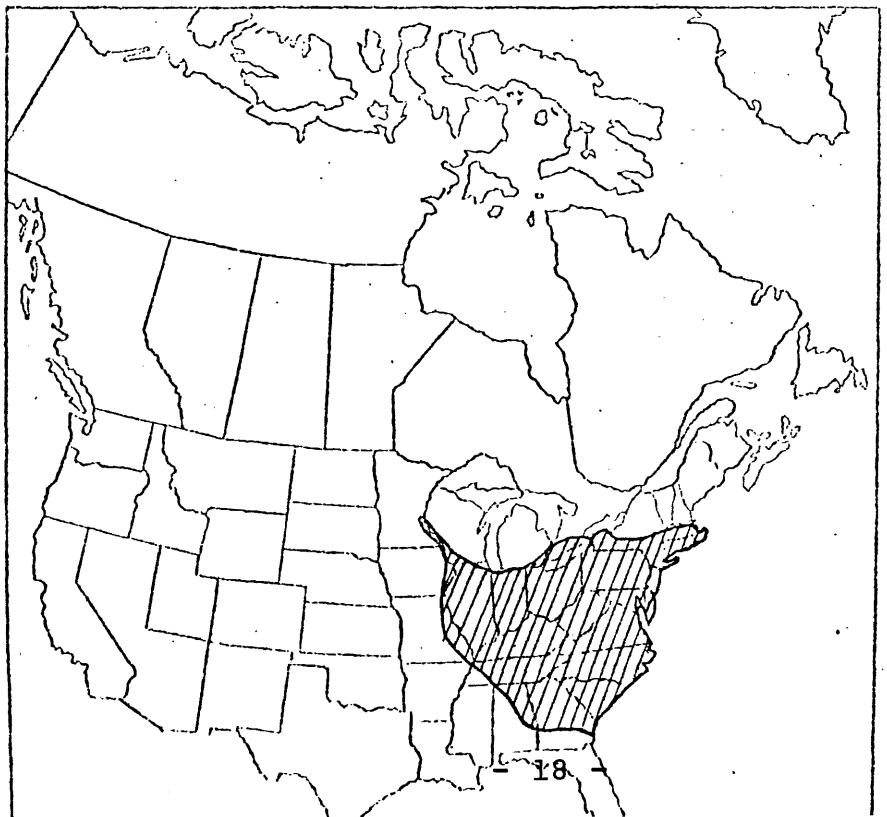


STATUS SHEET

ELEMENT NAME:	Aristida tuberculosa; (Triple-awned Grass)
FEDERAL STATUS:	None
STATE STATUS:	None
NATURAL HERITAGE PROGRAM STATUS:	Rare
BASIS FOR STATUS CLASSIFICATION:	This species has highly specialized habitat requirements and a very restricted geographical range. Of the six recorded occurrences of Aristida tuberculosa in Minnesota one is known to have been destroyed and another is suspected to have been destroyed.
PREFERRED HABITAT:	Sandy prairies and dunes.
DISTRIBUTION:	See attached maps.
OCCURRENCES IN MINNESOTA:	Aristida tuberculosa is known from two sites in Anoka county and one each from Wabasha, Houston, Winona and Sherburne. The Winona county site has not been verified since 1897.
# OF OCCURRENCES IN MANAGED AREAS:	One of the two Anoka county sites occurs in Cedar Creek Natural History Area, but the other sites are unprotected.
POTENTIAL THREATS TO SPECIES:	One of the sites in Anoka county was recently destroyed by the construction of a school. Threats to the remaining populations are not clear, but any large scale construction project or agricultural development could severely damage or destroy the sites or supporting habitat of the species.

Distribution of Aristida tuberculosa; Triple-awned Grass

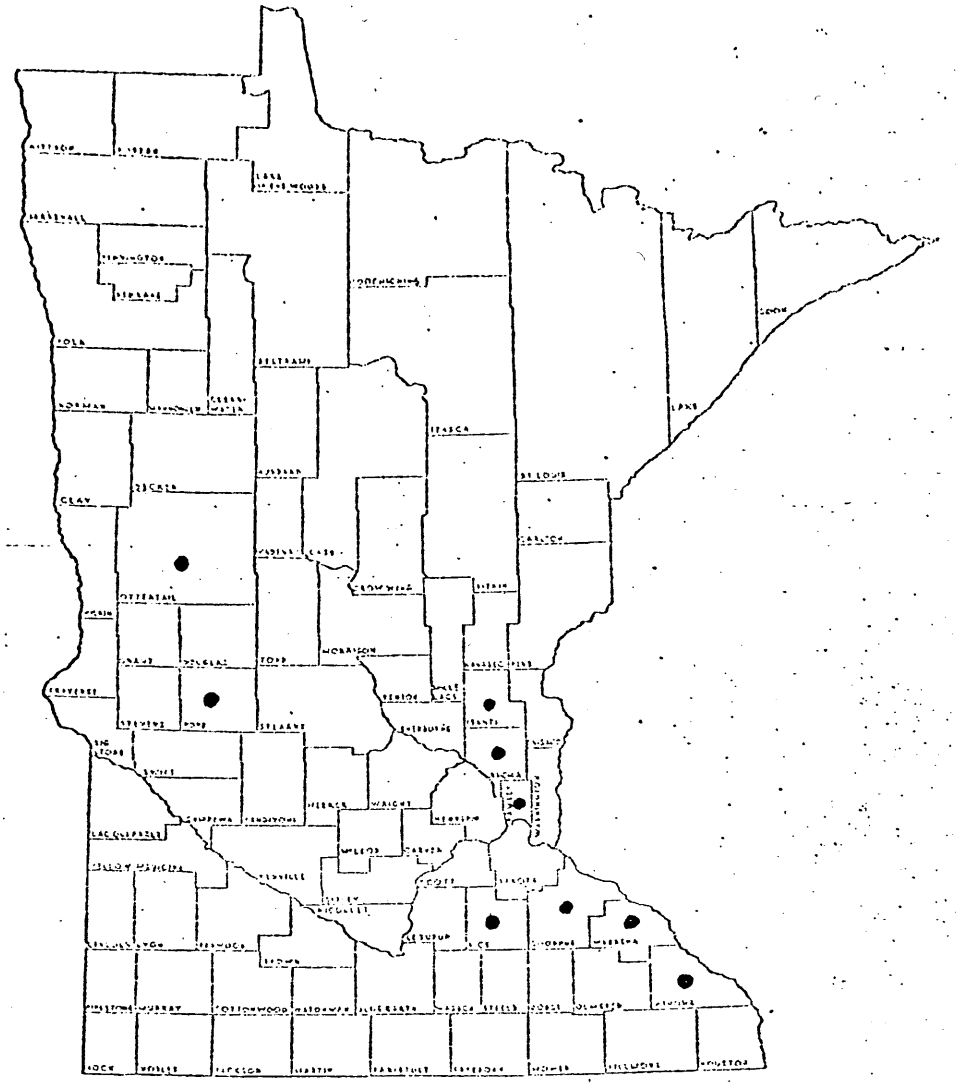


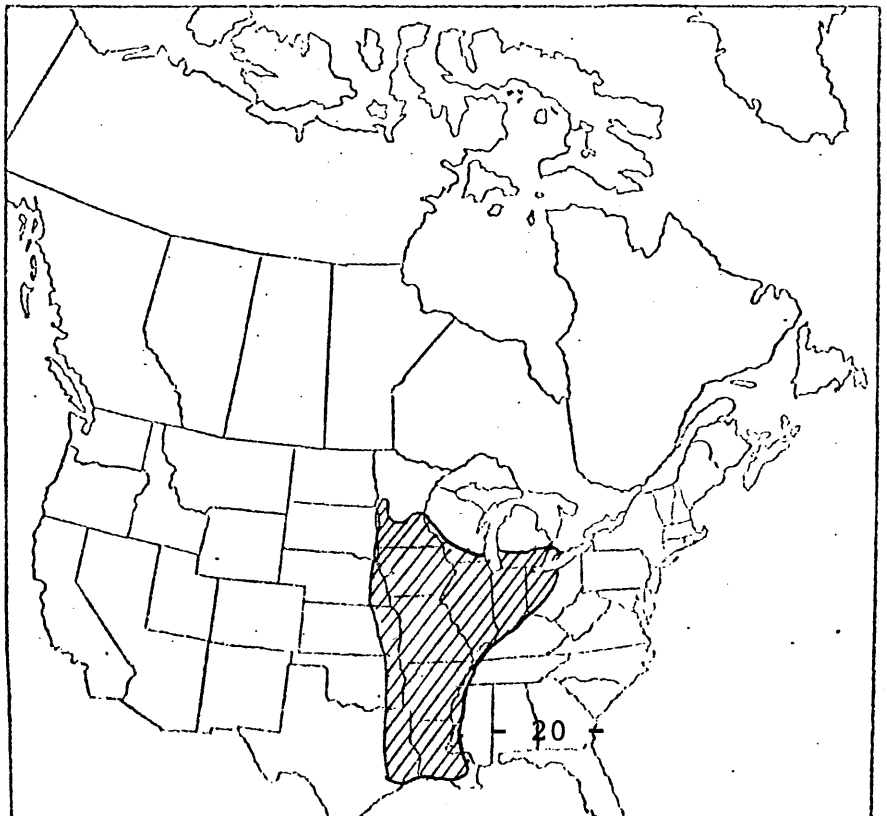


STATUS SHEET

ELEMENT NAME:	Hieracium longipilum; (Long-haired Hawkweed)
FEDERAL STATUS:	None
STATE STATUS:	None
NATURAL HERITAGE PROGRAM STATUS:	Rare
BASIS FOR STATUS CLASSIFICATION:	Approximately 65% of the occurrences of this species in Minnesota were recorded before 1910. The six records since then were from small remnant populations. One site was recently destroyed by gravel mining and another site faces imminent destruction from land conversion.
PREFERRED HABITAT:	Sandy soil, dunes, dry prairies and, in rare cases, mesic prairies.
DISTRIBUTION:	See attached maps.
OCCURRENCES IN MINNESOTA:	Hieracium longipilum is known from one site each in Isanti, Anoka, Wabasha, Pope, Dakota and Rice counties. In addition, the species is known historically from Goodhue, Winona, Ramsey and Ottertail counties. In these counties the species has not been collected recently and perhaps has been extirpated.
# OF OCCURRENCES IN MANAGED AREAS:	Two sites where Hieracium longipilum is known to occur are currently protected; Cedar Creek Natural History Area in Anoka county and Strandness Prairie in Pope county.
POTENTIAL THREATS TO SPECIES:	The small population numbers of Hieracium logipilum and the fragile and accessible nature of their habitat make this species susceptible to exploitation. It is especially vulnerable to agricultural practices, gravel mining and off-the-road vehicles.

Distribution of Hieracium longipilum; Long-haired Hawkweed





STATUS SHEET

ELEMENT NAME:	Grus canadensis tabida (Greater Sandhill Crane)
FEDERAL STATUS:	None
STATE STATUS:	None
NATURAL HERITAGE PROGRAM STATUS:	Threatened
BASIS FOR STATUS CLASSIFICATION:	The 'threatened' status for the sandhill crane has been officially recommended by the Records Committee of the Minnesota Ornithologist Union (1980). The basis for the classification rests upon the fact that in the 1800's and early 1900's the bird was considerably more abundant and widespread in the state than it is currently. At present its distribution is limited to the muskegs and swamps of northwestern and east-central Minnesota. The continued destruction of wetlands poses the largest threat to the species.
PREFERRED HABITAT:	An observation card survey for sandhill cranes in Minnesota produced the following analysis of habitat use (Henderson, 1978). During the spring migration, the months of March and April, nearly 80% of the reported observations were from old fields and small grain fields. As the breeding and nesting season commenced in May the habitat preference shifted to include wet meadows and marshes for nesting activities while the old fields were still utilized for feeding. Another major habitat shift was observed in August as the cranes moved from nesting marshes to begin feeding in the small grain fields of wheat, oats, rye and barley prior to their migration south.
DISTRIBUTION:	See attached maps.
OCCURRENCES IN MINNESOTA:	As illustrated by the distribution map the summer range of Grus canadensis tabida includes fifteen counties in northwestern and east-central Minnesota. At present approximately 125 breeding season occurrences have been entered into the Natural Heritage information system.
# OF OCCURRENCES IN MANAGED AREAS:	Nearly one-third of the 125 breeding season occurrences mentioned above occur within a variety of protected and managed areas including state wildlife management areas, national wildlife refuges and lands owned by the Nature Conservancy. The cranes receive adequate protection in all of these areas.
POTENTIAL THREATS TO SPECIES:	The most serious threat faced by the greater sandhill crane is the continued demise of wetlands; a habitat that is essential for the breeding and nesting activities of the species.

REFERENCES:

Green, J. C. and R. B. Janssen. 1975. Minnesota Birds: Where, When and How Many. University of Minnesota Presses. 217p.

Henderson, C. 1978. Results of an Observation Card Survey for Sandhill Cranes in Minnesota for 1977. Loon 50(2): 112-118.

Johnson, J. 1976. Distribution of Sandhill Cranes in Minnesota. Proc. Int. Crane Workshop I. 59-68.

Walkinshaw, L. H. 1949. The Sandhill Cranes. Bulletin No. 29. Cranbrook Inst. of Science.

SUMMARY:

There are two major population centers of greater sandhill cranes in Minnesota, one in northwest and one in east-central Minnesota. This second population center is concentrated primarily around Carlos Avery Wildlife Management Area which abuts directly on the eastern edge of the proposed SNA.

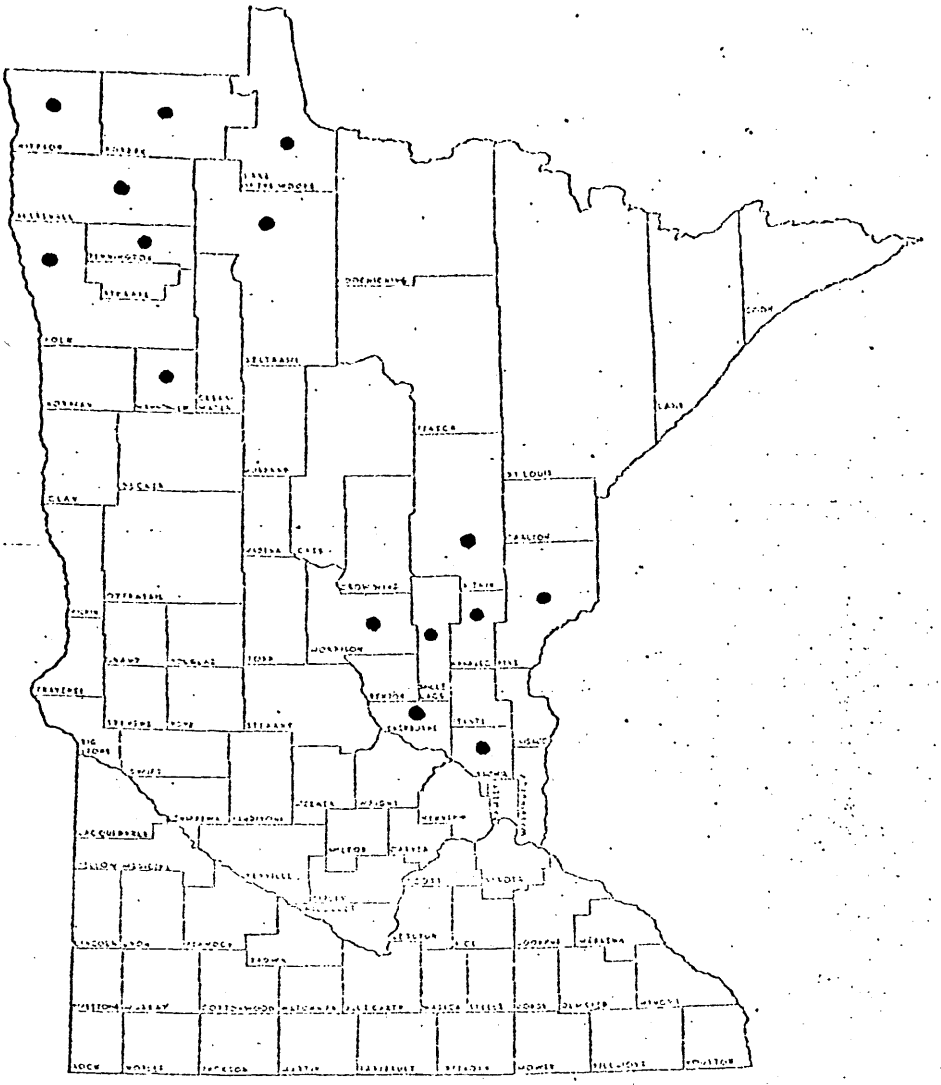
During the course of the 1979 SNA inventory of Boot Lake, the field crew did not observe any sandhill cranes. However, through the Observation Card Program initiated by Carrol Henderson, DNR non-game biologist, there have during the last couple of years been observations of cranes from the proposed SNA.

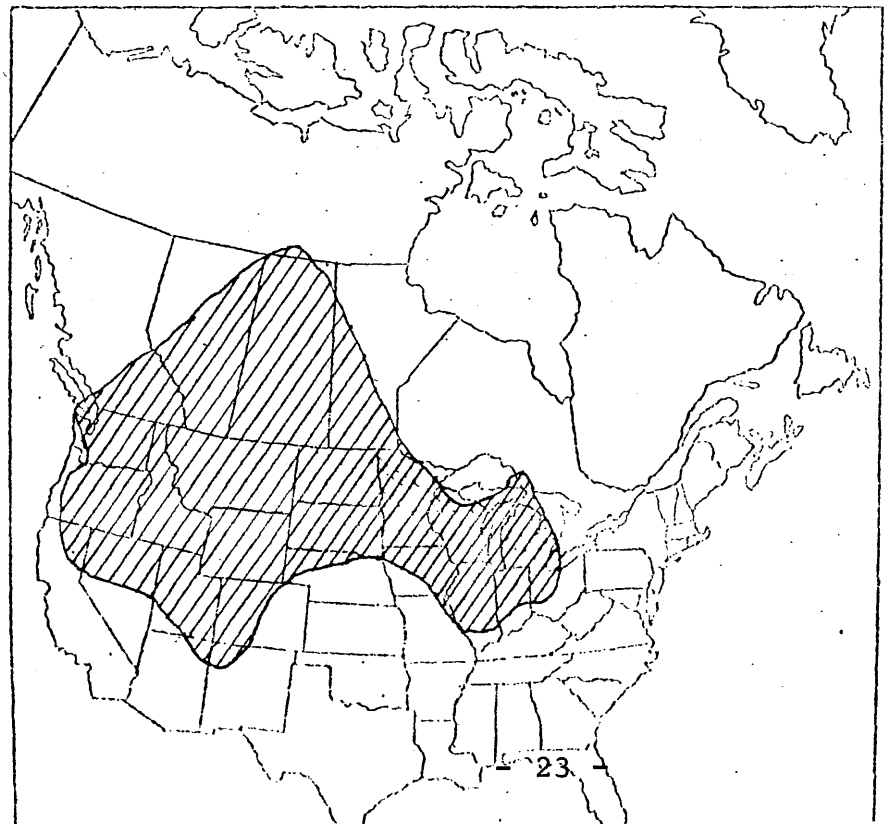
In 1979 W. Rohl reported that throughout April and May of that year he observed two adults on T33N R22W Section 17. He observed the birds in a marsh habitat of the Book Lake tract south of Linwood Lake and assumed the birds were a breeding pair.

In 1977 (April 8) one additional observation was reported by L. Knudson and R. Johnson in the Boot Lake tract. Little information about the observation was reported other than the fact that the sex and age of the bird was unknown.

In addition, during the last two or three years, several breeding pairs have also been reported within one mile of the northern and eastern boundaries of the Boot Lake tract.

Distribution of Grus canadensis tabida; Greater Sandhill Crane





STATUS SHEET

ELEMENT NAME: Emydoidea blandingi (Blanding's Turtle)

FEDERAL STATUS: None

STATE STATUS: None

NATURAL HERITAGE PROGRAM STATUS: Rare

BASIS FOR STATUS CLASSIFICATION: Like so many other members of Minnesota's herptofauna very little is known about the status of the Blanding's turtle. The infrequent sightings and collection records that have accumulated over the years indicate that the species is restricted to east-central and southeastern Minnesota. Some experts suggest that the species may be more widespread than the records suggest. On the other hand, because of the turtles dependence on wetland habitats, most professionals argue that the increasing demise of our wetlands poses a substantial threat to the survival of the species. In light of this concern the state of Iowa has officially listed the species as threatened while Wisconsin has put it on the 'watch' list.

PREFERRED HABITAT: Ernst and Barbour (1972) state that Emydoidea blandingi "prefers shallow water with a soft bottom and abundant aquatic vegetation." Throughout much of the year it is dependent upon the lakes, ponds, marshes, creeks and sloughs that provide such habitat. Although the turtle may feed, breed and overwinter in wetlands, in Minnesota it also appears to require sandy banks or dunes for nesting.

DISTRIBUTION: See attached map.

OCCURRENCES IN MINNESOTA: At present 13 records from specimens collected in 8 different counties (Anoka, Hennepin, Pine, Ramsey, Wabasha, Washington, Watonwan, Winona) have been accessed to the data base. Records from the 8 remaining counties illustrated on the distribution maps are sighting records for which the original reports have not yet been located.

The area best known for its population of Blanding's turtle is the Kellogg/Weaver Sand Dunes along the Mississippi River Floodplain.

OF OCCURRENCES IN MANAGED AREAS: At present none of the occurrence records are known to receive adquate protection.

POTENTIAL THREATS TO SPECIES: The life history and habitat requirements of the Blanding's turtle are still poorly understood. Nevertheless most biologists concur that the loss of wetland habitats may pose the largest threat to the continued survival of this species.

REFERENCES:

Babcock, H. L. 1919. The Turtles of New England. Mem. Boston Soc. Nat. Hist. 8(3): 323-431. (Available in a recent Dover reprint.)

Breckenridge, W. J. 1944. Reptiles and Amphibians of Minnesota. University of Minnesota Press. 202 pages.

Carr, A. 1952. Handbook of Turtles. Comstock. Ithaca, N.Y.

Conant, R. 1975. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co., Boston.

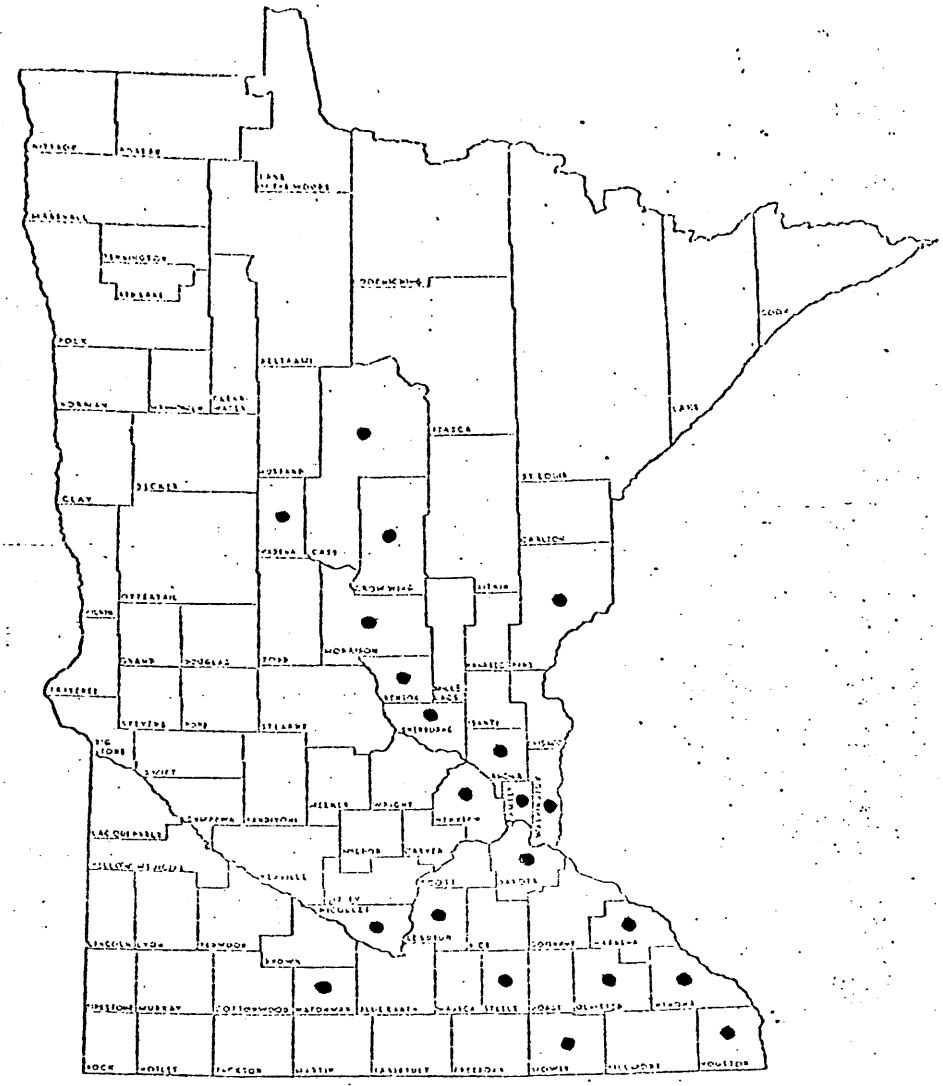
Ernst, C. and R. W. Barbor. 1972. Turtles of the United States. University Press of Kentucky. 347 pages.

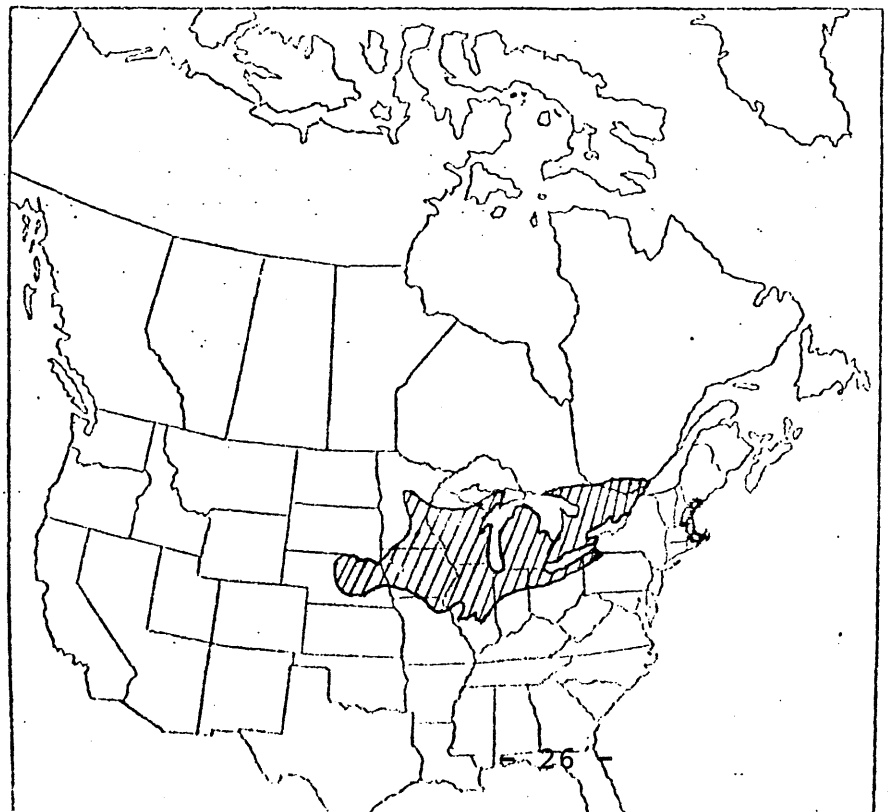
Graham, T. E. and T. Doyle. 1977. Growth and population characteristics of Blanding's turtle, Emydoidea blandingi, in Massachusetts. Herpetologica 33(4): 410-414.

SUMMARY:

Research efforts directed towards understanding the turtles biological requirements are direly needed. Some progress towards this goal was begun by researchers Mike Pappus and Bruce Brecke in the Kellogg/Weaver Sand Dune Prairie several years ago (to date this study has not been published). Nevertheless, considerable data regarding the species distribution and status is still needed. Meanwhile efforts to protect known nesting and breeding areas should be encouraged.

Distribution of Emydoidea blandingi; Blanding's Turtle





STATUS SHEET

ELEMENT NAME: *Pinus banksiana* wetland cover type.

COMMON NAME: Jack Pine wetland cover type.

NATURAL HERITAGE PROGRAM STATUS: Protection priority plant community.

BASIS FOR STATUS CLASSIFICATION: A natural plant community with an unusual assemblage of plants. Apparently rare in Minnesota.

DESCRIPTION & DISTRIBUTION OF THE PLANT COMMUNITY: Although Jack Pine (*Pinus banksiana*) is found occasionally in wetlands in Minnesota, it very seldomly occurs as a dominant. Bogs where Jack Pine is dominant are therefore noteworthy. This type of plant community is presently thought to be quite limited in its occurrence in Minnesota although it may be slightly more frequent in Wisconsin. The best known site in Minnesota at present is a small bog located approximately ¼ mile southwest of Boot Lake, Anoka County, where a Jack Pine stand occurs on a mucky peat soil growing with tamarack (*Larix laricina*), bog rosemary (*Andromeda glaucophylla*), leatherleaf (*Chamaedaphne calyculata*), narrow-leaved cottongrass (*Eriophorum angustifolium*),small cranberry (*Vaccinium oxycoccos*), sphagnum moss (*Sphagnum* sp.), and a species usually restricted to dry sites, the sweet blueberry (*Vaccinium angustifolium*).

Curtis in *The Vegetation of Wisconsin* (1959) made the following observations,

> Jack Pine, on the other hand, may achieve as high as 100 per cent dominance in certain bogs. This may seem surprising in view of the position of jack pine as a typical member of the driest sand barrens in the region, but in the boreal forests of northern Ontario, jack pine is most typically found on poorly drained flats in company with black spruce, Labrador tea (*Ledum groenlandicum*), sphagnum, and pitcher-plant (*Sarracenia purpurea*). The jack pine swamp forests of Wisconsin can be regarded as outliers of this more widespread Canadian community.

NUMBER OF OCCURRENCES IN THE STATE: Very few occurrences are presently known in Minnesota and they are located on the Anoka sandplain at the edge of the natural range of jack pine in central Minnesota.

OCCURRENCES ADQUATELY PROTECTED IN MANAGED AREAS: None known.

POTENTIAL THREATS TO COMMUNITY: This community is particularly sensitive to any construction or development project that would cause drainage or in some way alter the local water table.

REFERENCES:

Curtis, J. T. 1959. *The Vegetation of Wisconsin.* The University of Wisconsin Press, Madison.